Australian Model Engineering

September-October 1999

Issue 86

$5.50*

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In This Issue:
- ☑ Build a Victorian 'I' Wagon in 5" Gauge
- ☑ Engineering on WA's Goldfields Water Scheme
- ☑ Ball Valves — Everything You Want to Know

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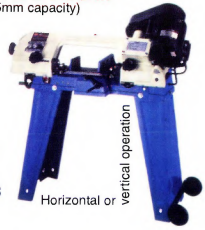

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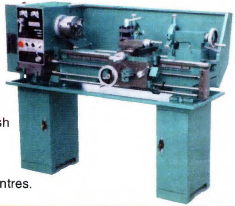

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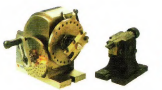

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ISSN-0819-4734

Publisher: Australian Model Engineering Pty Ltd.

ACN 008 627 825

Australian Model Engineering is published six times per year at two-monthly intervals. January is the first issue for the year.

Subscriptions

An annual subscription to AME costs just $32 within Australia. NZ is AUD$40; all other countries, AUD$45 surface or AUD$50 air. You can pay by cheque, money order, or overseas bank draft. You can also use your Bankcard, MasterCard or VISA credit card. **All Mail to:**

PO Box 21, HIGGINS, ACT, 2615, AUSTRALIA

Phone/Fax : (02) 6254 1641 or + 61 2 6254 1641 from overseas

Printing and Distribution

Proudly printed in Australia for the publisher by Pirie Printers Pty Ltd, 140 Gladstone Street, Fyshwick ACT 2609

Australia Post Print Post Approved.

Publication No. **PP228582/00001**

Distribution is by subscription, through hobby supply houses and related-interest sales outlets, and by Gordon and Gotch Limited to newsagents in Australia.

Contents

5 Comment

11 Victorian Railways 16 Ton "I" Wagon in 5"g — part 1

17 Back Issues

18 An Eternal Guard

19 Steam Chest

22 *Bunyip* — Build a 7¼" Bundaberg Fowler — part 8

26 A Statement of Clarification From the AMBSC

27 Bay Watch! — part 3

32 The Ball Check Valve — a Contemporary Look

35 Roundup of Recent Rallies —
1999 Hot Pot Run
Fourth Birthday Run at Bracken Ridge
Electric Muster at Moorabbin
36th Steam, Horse & Vintage Rally — Echuca

38 Drilling Round Materials

39 The Goldfields Water Scheme

45 Indexing in the Lathe
Another Pipe Bender

46 Club Roundup

49 Coming Events

50 IBLS 2000 Tour Proposed Itinery
11th Miniature Traction Engine Rally — Inverell

51 Taper Turning by Geared Crossfeed Drive — part 3

55 Sparks 'n' Arcs

56 Product Reviews
Automatic Drain Cocks

58 Letter Box

61 New Subscription Form
News Desk **Important Announcement**
Classifieds

63 Advertising Index

Front cover

Some of the detail to be seen on the deck of Brian Lemon's cargo cutter* GEM. *An impression of size is given by the fact that the hull is only 18" long. The photo was taken with a 28mm lens, 1/60 speed at f11 on 100 ASA film. Photo: Brian Lemon

Machine Shop Methods

Machine Shop Methods
By Lorus J Milne
Reprinted by Lindsay Publications

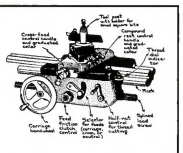
If you're just starting out in the world of metalworking. You have to have this. If you know some aspects of machining metal, but realize that there are big holes in your knowledge, then, again, this is for you. When Dave Gingery first showed me his copy he commented that he thought this was the best beginner's book he had ever seen. And I agree. It's good.

Chapters include shop machinery, drawings and specifications, handwork related to machining, the lathe, turning work between centers, work supported chiefly by the headstock, outside machining, inside machining, threads and thread cutting, drills and drilling, the drill press, the shaper, the miller, the grinder, holding the workpiece: a summary, other shop machines, useful tools and fixtures, gears and gear cutting, cutting speeds and finish, accuracy in machining assembling machined parts, processing and finishing metal, materials, and more.

You get brief descriptions of tools and how they work. I've never used a taper attachment for the lathe, but now I have a general idea how it functions. The explanation is clearly written, easy to read and understand, and provides sufficient detail. It sounds a lot like Dave Gingery teachings.

Most of this you will read once or twice. Once you have an idea of what the topic is all about, you can dig into more complex texts. When you do, you'll find the "heavier" books are easier to understand.

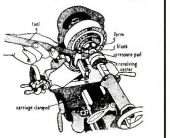
What's really grabbed my eye in this volume is chapter 17 with its complete dimensioned plans for tools and fixtures. You can build a cleaner for chuck threads, faceplate clamp, faceplate angle bracket, draw-in collet attachment, spindle-nose cap, collet closer, collet, micrometer carriage stop, external-internal threading tool, heavy-duty boring bar, heavy-duty boring tool holder, centering Indicator, dividing fixture, lathe boring table, cross-feed chuck and collet holder, spherical turning attachment, cutaway tailstock center, drill-countersink holder, tailstock die holder, tailstock stover attachment, taper-shank drill driver, perforating die set,



simple forming die set, drill-angle tester, fly cutter for the drill press, and auxiliary table for the drill press. Now think of it this way: When you buy the book, you get each plan for less than a dollar a piece, and the rest of the book is thrown In for free!

But the rest of the book is great too, both plans and a book for the price of just one. Not a bad deal, I'd say.

A book certainly worth having. A must-have adjunct to the Gingery series of metal shop books, a book that has been an essential part of the Gingery library. Get your own copy! 51/2 x 8 1/2 soft cover 376 pages



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Comment

AME's volunteers —don't abuse them!

In the past few days, two of the volunteers who put a lot of effort into ensuring that you receive *Australian Model Engineering*, have been on the receiving end of abusive phone calls. These calls are either from people who are just plain ill-mannered or maybe they are just totally unaware of how the AME team functions and therefore, not as patient as they otherwise would be. It is not the first time this has happened and that is why I have decided to use this opportunity to briefly explain how the AME organisation works.

Firstly, the most important point to realise is that AME does not yet sell enough copies to be able to pay for any full time staff. The names you see in the column to the left are volunteers, working from their homes in different parts of Australia, who are prepared to give up some of their time, usually of an evening, to ensure that you continue to receive your magazine. Sure, some of the names have changed over the years, but, as this is issue 86, you would have to admit that generally they have done a pretty good job.

There are the Contributing Editors, the people who either have their own regular column or help in some other specialised way, there are the people who do some occasional editing, the draughters who knock your drawings into shape for publication, the contributors, who have sent in the articles you will read in this issue, and Phyl Oliver. Phyl types up nearly all the handwritten articles onto computer disk for me as well as placing all the subscribers magazines into envelopes, addressing them and mailing them out — a big job!

Then there are the people you are most likely to have contact with. Brian Carter prepares all the display ads you see at the front and back of each issue, he looks for new advertisers as well as working on some special projects which you will see in the coming months. Without Brian's work with the advertising, the magazine would not be viable. The subscriber data base is maintained by my wife Mandy who also has a full time job, which enables me to spend the time needed to produce this magazine. AME Retail is run by Les Mouat and like all the other people, he works from his home, making time in the evenings.

These people all have spouses who are often inconvenienced, full time jobs to hold down and sometimes, not a lot of spare time. For your convenience, they have answer phones, where, if you phone during the day or when they are unavailable, you can leave a message and they will either respond to your request or get back to you as soon as they possibly can. This also includes myself — you should see my loungeroom where I put this magazine together!

There are times when we appreciate your patience. Because we are doing our best to keep costs down and ensure AME continues to grow, we do not bank every day, we only mail out retail orders once a week and we prefer to make phone calls in the cheaper off-peak times. Letters cost less than STD calls. If we do not work to a tight budget we could spend a fortune on bank fees, phone calls and higher postage rates — we would rather spend the money giving you a better magazine.

David Proctor

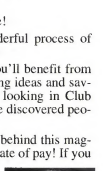
Join us in a great hobby!

If this is your first issue of *Australian Model Engineering*, welcome!

In successive issues we cover many topics centred on that wonderful process of model engineering — alias *tinkering*.

If you're new to model engineering as well as to our magazine, you'll benefit from getting together with other model engineers — we're good at sharing ideas and saving each other money! If you don't have any contacts, start by looking in Club Round-up to find a club that's near to you. Many of our readers have discovered people with similar interests literally just around the corner.

Helping other model engineers is the simple idea of the volunteers behind this magazine. Our readers write items for us — for the same (non-existent) rate of pay! If you have ideas, opinions or techniques that you feel would be interesting to others (especially from the newcomer's angle), please drop us a line. We can send you a useful guide and help with preparing artwork or editing.



I hope you'll enjoy the great fellowship that makes our hobby special, and that you'll support our advertisers — after all, they help pay our bills!

David Proctor
Managing Editor

Victorian Railways 16 Ton "I" Wagon in 5" Gauge — part 1

by Keith Hartley

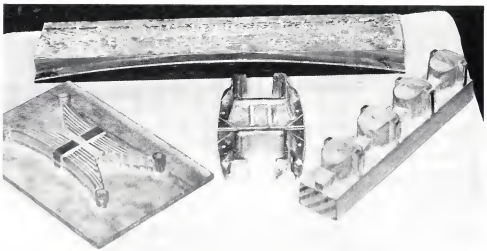
Drawings for publication from the author's original sketches by Rex Swensen. Photos by the author unless otherwise indicated.

The "I" class open wagon, as used by the Victorian Railways, was typical of this type of wagon used by many railways around the world. The classification "IA" also appears on photos with only very small differences between the two (Maybe one of our readers could tell us why the different classifications).

I shall now describe to you the methods I used to build a model to the scale of 1" to 1' using Victorian Railways drawing No 7729. I might point out that I did not fit brakes and have used coil springs.

The "W" irons were the first item made so to mark out and make one to the drawing (Component Details Sheet 1). I used the alternate top (Component Details Sheet 2) to accommodate a coil spring in conjunction with a dummy spring. This first one maybe made and kept for use as a template, it saves lots of time marking out in future. Most of the cutting out was done on a band saw and cleaned up with a file. For the slot to take the axle box, I used a piece of metal $^{11}/_{16}$" wide as a gauge. Make and fit the keeps to the "W" irons.

These IA wagons look like they have seen a lot of hard work over the years but judging by the overgrown rails in this 1993 shot, those days are pretty well behind them.



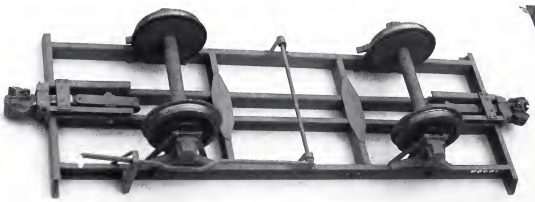
The author's former for shaping the ends of the wagons, together with patterns for two dummy leaf springs, coupler pocket covers and four axle boxes.

Axle boxes

I made a pattern to have the four axle boxes cast in one piece, stacked on top of each other so to speak. This makes for easier machining as follows.

Place the casting in the machine vice on the mill so that the back and sides of the axle boxes are clear of the vice. Machine the back and two sides then change to a Woodruff cutter and machine the slots to suit the "W" irons, using one as a gauge to get a nice running fit. Then cut into individual axle boxes and machine tops and bottoms.

Now mark out for the axle and extended oil hole, set up in the 4-jaw chuck and drill, no need to ream or bore the $^{3}/_{8}$" hole. Later, on assembly, place a piece of felt in the oil hole to keep the dirt out. Drill the other holes shown, one for oil, the others for the dummy spring if required.

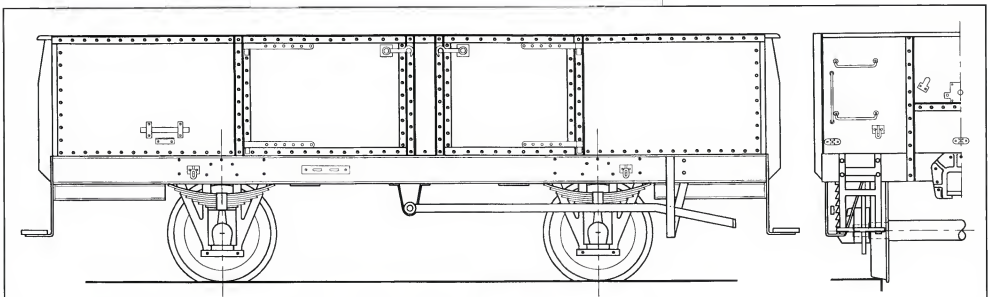


Under view of the frame assembly. The handbrake lever has been fitted as have the knuckle couplers and the wheels, which are of the plain disc type.

Wheels and axles

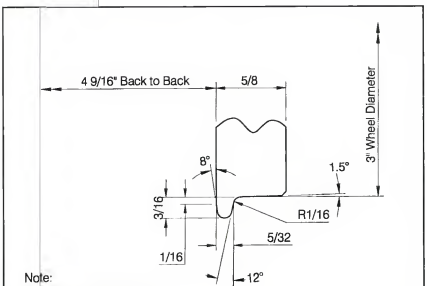
Turn the wheels and axles for the standard you wish to use (I have used the AALS narrow gauge standard). When turning the journal on the ends of the axles, use the axle box as the gauge to get a fairly free running clearance.

After pressing or Loctiting®, the wheels onto the axles, place an axle box on each end of an axle and then a "W" iron onto each axle box and measure over the outside faces of the "W"



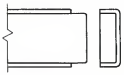
V.R. I OR IA TRUCK - GENERAL ARRANGEMENT

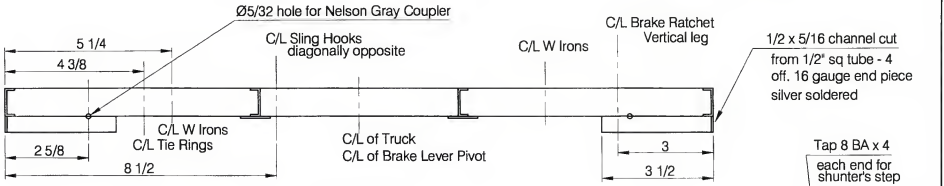
The author's completed 'I' wagon — follow the easy instructions and you can have one of these too! Why not make a whole batch of them? The prototypes were to be found all over Victoria and in South Australia.



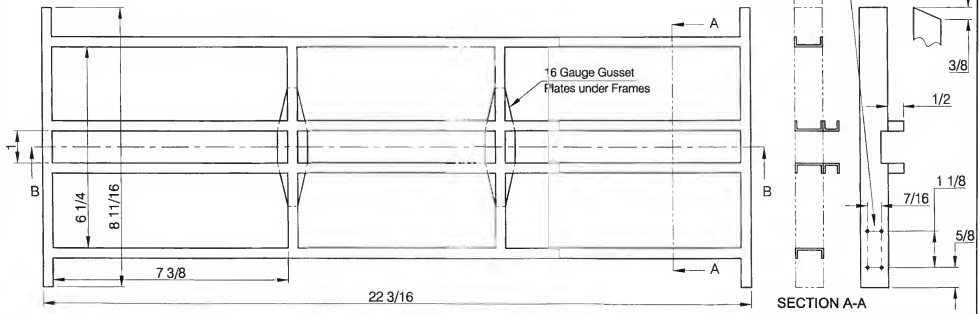
WHEEL TREAD DETAILS

Note: All channels 7/8"x5/16" except where shown. Make from 7/8" square 16 gauge tube.



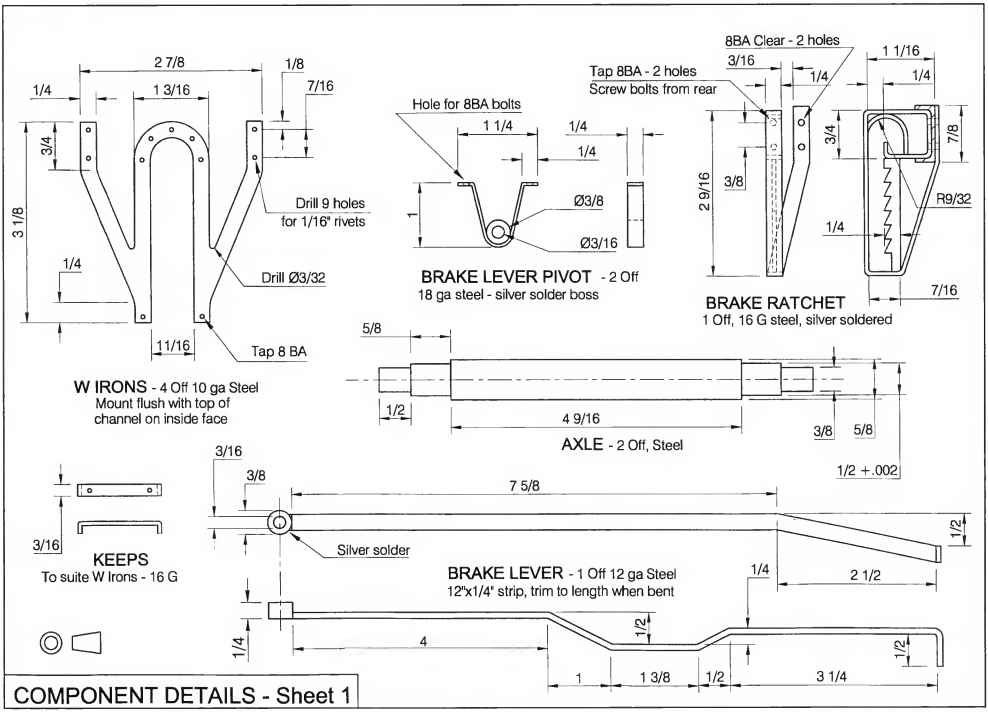


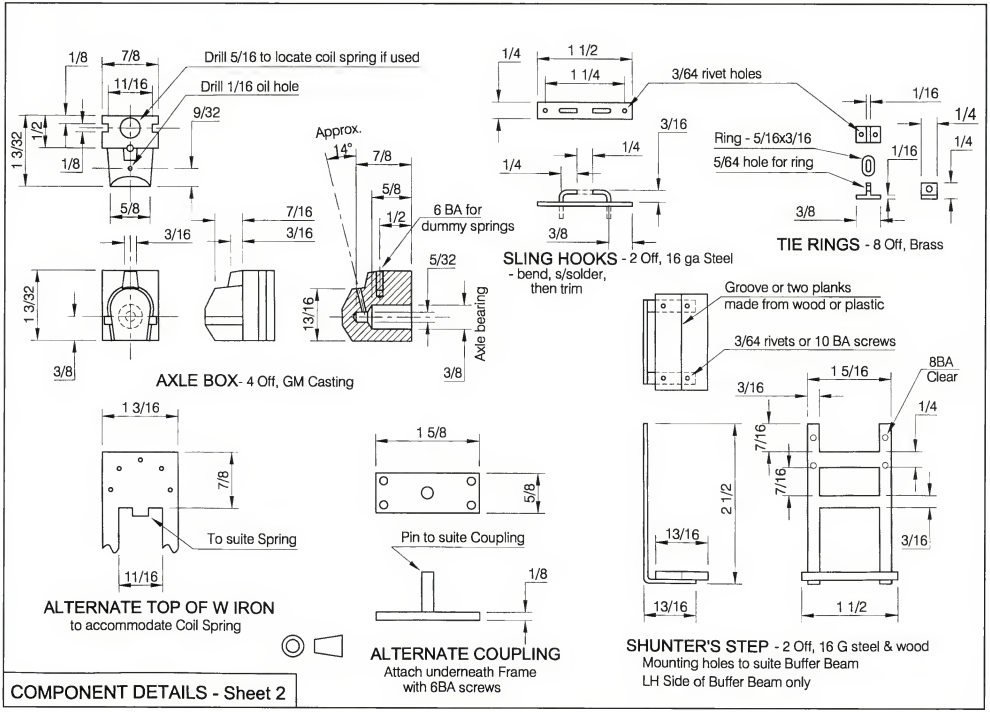
SECTION B-B



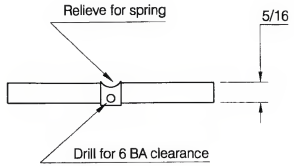
SECTION A-A

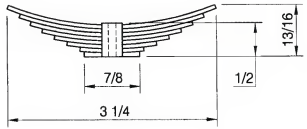
FRAME FABRICATION


2 7/8
1/8
1/4
1 3/16
7/16
3/4
3 1/8
Drill 9 holes
for 1/16" rivets
1/4
Drill Ø3/32
11/16
Tap 8 BA
W IRONS - 4 Off 10 ga Steel
Mount flush with top of
channel on inside face
Hole for 8BA bolts
1 1/4
1/4
1/4
1
Ø3/8
Ø3/16
BRAKE LEVER PIVOT - 2 Off
18 ga steel - silver solder boss
8BA Clear - 2 holes
3/16
1/4
Tap 8BA - 2 holes
Screw bolts from rear
2 9/16
3/8
1 1/16
1/4
3/4
7/8
R9/32
1/4
7/16
BRAKE RATCHET
1 Off, 16 G steel, silver soldered
5/8
1/2
4 9/16
3/8
5/8
1/2 +.002
AXLE - 2 Off, Steel
3/16
3/8
7 5/8
1/2
Silver solder
3/16
KEEPS
To suite W Irons - 16 G
BRAKE LEVER - 1 Off 12 ga Steel
12"x1/4" strip, trim to length when bent
1/4
2 1/2
1/2
1/4
4
1/2
1
1 3/8
1/2
3 1/4
COMPONENT DETAILS - Sheet 1

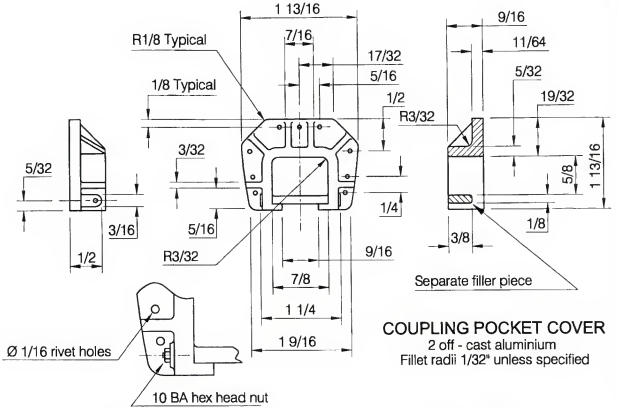


COMPONENT DETAILS - Sheet 2

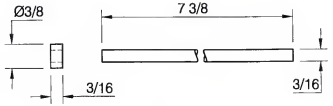




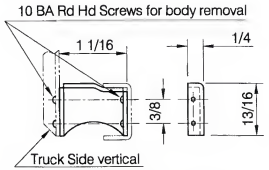
DUMMY LEAF SPRINGS
4 off - cast aluminium



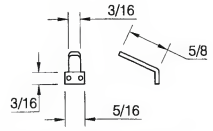
COUPLING POCKET COVER
2 off - cast aluminium
Fillet radii 1/32" unless specified



BRAKE LEVER SHAFT & RETAINING COLLAR
1 off each



SIDE MEMBER TO FRAME FILLER
4 off - 16 G mild steel



TARPAULIN BAR STOP
16 G mild steel

COMPONENT DETAILS - Sheet 3

irons. Add on $1/16$" and you will then have the measurement for the inside faces of the side sills on the underframe. If you are using different axle boxes, maybe with needle or ball bearings or a different wheel profile, then this method will give the required dimension for the inside measurement of the side sills.

Frame

For the frame I used square section tube cut down on the band saw to the required $5/16$" which gives a nice channel section when cleaned up on the linisher or a bit of elbow grease with the file.

Prepare the ends of the side sills to fit into the buffer beams, then carefully mark the position of the "W" irons and also position for the other attachments to the side sills. It would be wise to make the brake ratchet at this stage so that it also can be marked out onto one side sill at the right hand end.

Mark out the holes in the buffer beam. These are a hangover from the buffers that were fitted before the days of auto couplers. We used the left side of each buffer beam for the shunters step. Drill the holes as marked out in the side sills and buffer beams at this stage as it is easier to do now before welding the sills and beams, which must come out square and flat.

Rivet the "W" irons and any other pieces for riveting at this stage and have a trial fitting of the brake ratchet before proceeding with the centre sills and intermediate cross members.

With the centre sills I found that the hole for attaching the "Nelson Grey" auto coupler came right on the join of the main channel and the small channel. This was required in order to maintain the $3\frac{1}{4}$" centre height for the coupling and was achieved by cutting a small vee in both pieces. A touch with a small round file before welding the two channels together, check with the $5/32$" pin, then weld the centre sills to the buffer beams. I have shown an alternate suggestion for mounting a "Nelson Grey" coupling without the spring gear. Some builders may wish to use other couplings or coupling pocket covers so no doubt will work out their own alterations and dimensions.

Make up the brake lever pivot brackets and attach under the frame and then it's time to make the brake lever. The dimensions shown are as near as I can give — it is however, a case of bending and tying on the job and giving a little adjustment here and there.

The shunters' steps

Cut the required strips of 16g steel and then drill the holes for mounting. Do not bend yet, but silver solder the four pieces together (I used a piece of steel with the appropriate tapped holes to secure the verticals). It will also require holes under the joins to stop the assembly joining to the jig. Now you may bend the bottom out to hold the step.

The sling hooks

Cut and drill the base then bend up a length of $1/16$" round into a large flat bottomed U shape so that it goes right through the base. Silver solder together, hold in the vice to cut and shape the hooks then cut off the extension underneath.

Rope ties and rings

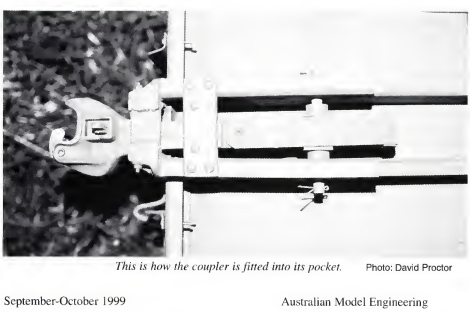
Eight of these fittings will be required per wagon so with a piece of $3/8$" brass bar, 4" or 5" long in the vice, mill down both sides to leave an inverted 'T' section, cut the bar in the band saw and place in vice on the mill the other way up and clean off to size. Over to the lathe and part off to length (I have a $1/32$" wide parting off tool which does a good job).

To drill the many holes I made a simple jig consisting of a short piece of angle iron to which a piece of $1/16$" plate, with a suitable cut out to locate the T sections for centre drilling and drilling to required size, is attached.

To complete, form up the rings and silver solder the joins in them after inserting in the T section (a fiddly job).

In the second half of this article we will make the body and detail the wagon.

To be continued ...



This is how the coupler is fitted into its pocket. Photo: David Proctor

An Eternal Guard

by Warwick Allison

Drawing for publication from author's sketch by Dave Adams

The introduction of those flashing bicycle tail lights has been a boon to night running on miniature railways. One of these hanging off the guards van is a big improvement over the torch previously used. But I have found that they are often made of a very fragile plastic, and the batteries still don't seem to last too long, although they are still much better than the conventional torch. They also flash too fast. The flashing light on the back of a full size train blinks about once a second.

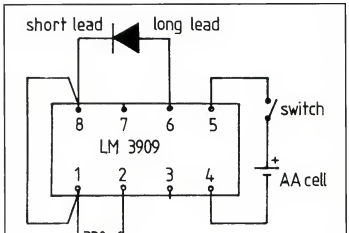
Now what I wanted was a flashing light that lived in my tool kit, and always worked when I needed it without any unplanned attention (like buying new batteries). As my night running occurred only very infrequently, it had to have a long shelf life too!

The fact that there was a simple solution dawned when I was involved with an exercise on the full size railways to find a better solution to the light on the back of the train. Most electronic cook books (and for that matter, the back of the Dick Smith catalogue) describe a simple circuit using an LM 3909 chip. With a single AA cell it promised to go continuously for several months. Tests proved that this was so, with possible variations such as bigger cells extending the time even further, and additional LED's, all in parallel, to increase the light output.

I built mine in a small plastic box about 80 x 50 x 30mm deep. I used a single 10mm diameter clear high intensity size LED. The 3909 chip was mounted on a small piece of vero board. The copper tracks between the opposite pins were cut by a countersink with a small drill. The only other electronic component, a small 300µf capacitor was soldered direct to the relevent pins on the vero board, as was the LED. I used an AA size battery holder and a pushbutton on/off switch wired in series and again to the vero board. To give maximum reliability, an alkaline cell was used.

The LED (and mounting bezel), switch and a suitable mounting bracket for attachment to the coupler of the rear vehicle were mounted on the plastic case with, of course, the other componentry stuffed (or mounted) inside.

The LED is very bright and it is painful to look at it directly at close range. In service, it is visible at a considerable distance (exceeding 100m) and the slow flash rate is much more pleasing than the bike flasher.



With not much imagination, I'm sure you could work the battery and components into the vehicle and place the LED as part of a scale 'end of train' unit!

The cost? About $15, or less if you have some of the components on hand.

How long will it last? Well, its not quite eternal, but as it hasn't died yet (over 12 months) I'll have to take that question on notice!

Steam Chest

with Dave Harper

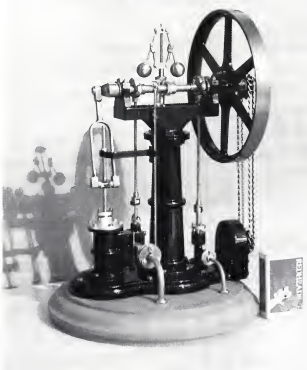


Photo 1

Hi there, steam fans, and welcome to another collection of steamobilia. The pictures of the old model steam loco in the May/June *Steam Chest* certainly produced a lot of responses.

One of the first was from an old friend, Dr Andrew Auld, who phoned me to tell me he had despatched a book called *Model Railway Engines* by J E Minns, published by Octopus Books, London in 1969) via a friend, that would answer my questions.

Sure enough, when it arrived a couple of days later, the book contained photos of a range of old toy locos, generally known as 'piddlers' for their habit of leaving a trail of oily water behind them when they were running.

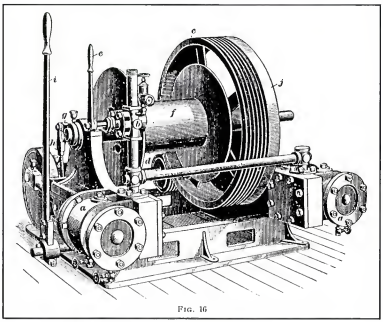


FIG. 16

Friction- Geared Winch

The model in question is almost certainly one made by Newton & Co of London, around 1870-80. Newtons are recognised as one of the better quality manufacturers. The main identifying features are the outside brass plate frames and the turned steam dome. These features seem to be unique to Newton's products.

I was able to pass on this information to Dave Jensen in Collinsville, who was pleased to know that he has quite a valuable antique on his hands!

Thanks to all the other readers who sent me information by email as well as snail mail! It seems that I could have set a precedent for this column becoming an identity parade for old toy steam engines, as I had several requests to put photos in from different people. This seemed to be getting away from the purpose of the column, and after discussion with the Editor, we agreed that the proper forum for these 'please identify' queries is the *Letter Box* column. There will be a few showing up there, I have no doubt! *(There is one with phtos on this issue ... Ed.)*

Another welcome letter was from Arnold Thuys of Port Adelaide, SA. I had the pleasure of meeting Arnold when he was in Brisbane a little while ago, and we had an enjoyable afternoon going over my library and talking steam engines.

Arnold is also interested in the steam winch idea, and kindly sent me a copy from an old ICS textbook he has, on steam winches. This chapter clears up the confusion about the different types of winch, and is worth quoting at length:

"Hoisting Machinery, Classification and Nomenclature.

Steam hoisting engines, also called steam winches, are used on board ship for hoisting cargo and lowering the same. Sometimes they are also used for warping a ship into its dock or alongside the pier. When warping, the rope is passed several times around a special drum called a winch head or gipsy head, and the free end is taken off continually while warping and coiled on deck. By warping is meant the act of pulling a vessel toward a point by means of a rope fastened to some stationary object outboard.

Steam Winches consist essentially of a hoisting drum or gipsy heads, or both, operated by a single or duplex steam engine. In very small winches used for light work, such as hoisting ashes, the hoisting drum is often attached directly to the crankshaft of the engine. In all larger winches the hoisting drum or gipsy heads, or both, are placed on a separate shaft and driven from the crankshaft by means of spur gearing, helical gearing, worm gearing or friction gearing, which is so proportioned that the drum rotates much slower than the engine crankshaft, thereby permitting small cylinders to be used.

Steam winches may be broadly divided into two classes, reversible and non-reversible. Non-reversible winches hoist the load by steam; to lower the load, the drum is detached from the control of the engine and a brake, applied tightly during this act, is slacked off, thus permitting the load to descend by gravity at a speed determined by the brake tension. In reversible winches, the load is lowered by

reversing the engine, thus keeping the load at all times under control of the engine.

Steam hoisting gear is made in various forms to suit different purposes. When the engines drive a vertical drum, smaller in the centre than at the ends, used in practice mainly for warping, the gear is called a steam capstan. When the hoisting shaft is horizontal and carries chain wheels, usually called wild cats, for the anchor chains, it is called a windlass. In addition to the wild cats, windlasses are often fitted with gipsy heads to permit them to be used for warping or hoisting cargo too heavy for the ordinary cargo winches.

Frequently, capstans and windlasses are combined into one machine which is called a capstan windlass. In some instances these gears are not driven by a direct-connected steam engine, but derive their motion from the nearest steam winch by means of an endless chain, called a messenger chain. The chain passes over two messenger wheels, one being fitted to the steam winch and the other to the remote gear.

Most winches and capstans are arranged in such a manner that they can be worked by hand in case the steam engine cannot be operated."

Well, that clears up a few questions I had on what to call the various drums on the winch. We can bandy terms like gipsy heads and wild cats around now, to show off our superior knowledge!

That article, of course, was about marine winches. Steam winches were widely used in mines for hoisting and haulage, and it so happens that I have a complete 1CS volume on winding and haulage. We'll delve into that another time! It does show, though, that there is an almost infinite variety of steam winches, all crying out to be modelled!

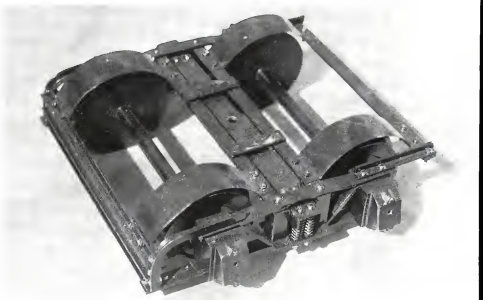


Photo 3

A friction drive winch

The **figure** reproduced this time shows a friction geared winch and is non-reversible. It happens that I'm in the process of restoring a small friction geared winch at the Boiler House. I must get some photos when it's all back together.

In these winches, the drive is via two cast iron wheels that have V grooves machined on the periphery. The driven drum has its bearings mounted in an eccentric which when turned one way engages the two wheels and drives the drum. When the eccentric is turned the other way the drum wheel is forced against a wooden brake block. The latter position is the normal rest position. When the operating lever is pulled over, the drum is pushed against the driving wheel and the hoist operates. Holding the lever in a mid position lets the drum free-wheel, and by letting go of the lever the drum is lowered onto the brake, thus holding the load.

This would be a simple type of winch to model, once a form tool has been made to turn the grooves in the drive wheels! Could be easier than cutting gears.

To show how many uses these winches had, the one I'm restoring came from a timber yard, where it was used to haul logs up to the mill. I've also seen one that was used in the old whaling station on Moreton Island to haul whales up the slip. It was also used to tear the blubber off the whale carcasses — must have been a lovely job!

At the other end of the scale are the

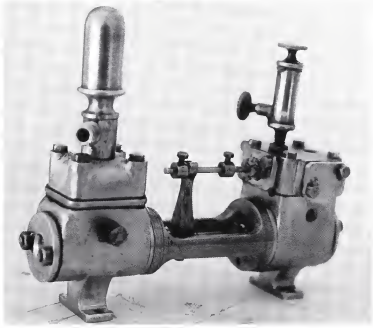


Photo 2

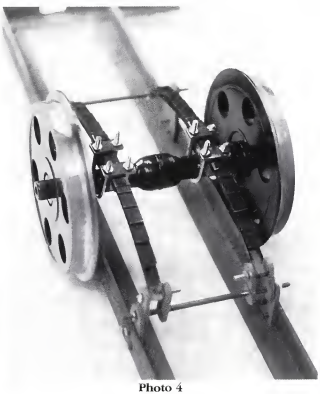


Photo 4

huge winding engines used in deep mines. Look out for an article on the steam engines of the Keweenaw Peninsula copper mines in the USA. The Quincy Mining Co winding engine, still *in situ* as a tourist attraction, is reputed to be the biggest winding engine ever built. It is an inverted vee twin cross compound engine with cylinders of 32" and 60" bore and 66" stroke! The winding drum is 30ft dia and holds 10,000ft of rope! That's some steam winch.

Arnold Thuys' Benson engine

Along with the winch info, Arnold also sent me a photo of his completed Benson engine. (**Photo 1**). He made the helical gears driving the governor, also the small worm gear and pinion under the cover at bottom right. It allows a small electric motor to turn the engine for display, and Arnold admits that it keeps the steam and water off his nice clean model! No harm in that, I'd say, Arnold, with a model as pretty as that!

Dave Sampson's latest

Another photo that I acquired recently was from Dave Sampson, which shows he's no slouch as a photographer either. **Photo 2** is of his latest model pump, sort of like half a Worthington pump! Dave says it's a typical simplex pump used in many of the merchant ships he served in. The steam bore is 3/8", pump bore is 1/4" and stroke is 7/16". The cylinder blocks are of brass and the centre spacing piece is of steel. Dave reckons he had grave doubts as to the wisdom of making the centre piece from steel, especially while he was sweating away filing it to shape! Brass would have been much easier.

Profound words on the foundry

Some time ago I received a letter from Ernie Henne of Moe in Victoria. Ernie told me that he had acquired a great pile of old magazines from a foundry that closed down in Melbourne. Working through the two trailer loads, Ernie came across an article on making castings for a Corliss steam engine. He thought I might be interested. Well, I am, but the old foundryman that wrote the article used so many technical terms that I got completely bogged down! I believe some of our AME people have recently being doing a foundry course — would anyone like a copy of the article to translate into terms that a layman could understand? It may just need a glossary attached, but I'll be happy to forward a copy to anyone willing to translate it for us!

Update on *Red Fred*

I've been asked to send in some photos to show how I'm progressing with my 5" gauge model of the QR diesel railmotor known as *Red Fred*.

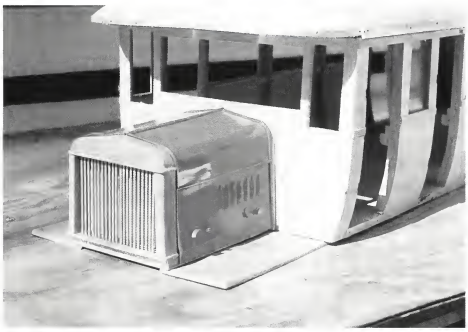


Photo 5

The running gear is now complete, and I finally cracked the problem of making the louvres in the bonnet, so once I get rid of this rotten flu bug I can get on and finish off the bodywork. Then I have to build the 4-wheel wagon that will contain the motor, battery and radio control gear to push *Red Fred* along. The idea is to have a realistic model that can operate without over-scale people spoiling the illusion!

Having assembled the front bogie all nicely painted black, I found it very difficult to photograph it satisfactorily! **Photo 3** is about the best one I've taken so far! Ever seen a train with mudguards before? Me neither, but *Red Fred* has them! Axle boxes are cast iron from Hobby Mechanics, wheels are cast iron from Ernie Winter, bogie frames are steel strip and the bull-bar is brass angle.

Photo 4 shows the rear wheels, turned from 130mm dia discs of aluminium with double ball races pressed into the hubs. The axle is from a lump of 1" dia brass bar, and the leaf springs as shown were too soft, so extra leaves have now been fitted.

Photo 5 shows the radiator and bonnet — dig those louvres! Still got to make the radiator filler cap, and the running boards are still in primer. The bonnet and running boards are made from Milo tins!

The roof was almost a boat-building exercise — plank on frame out of 4mm MDF with timber framing. The top is covered with calico with fewer wrinkles than the prototype! **Photo 6** is the underneath view.

That's about it for this time, until next time, happy steaming!

Don't forget ...
You can email Dave on:
sandave@bytesite.com.au

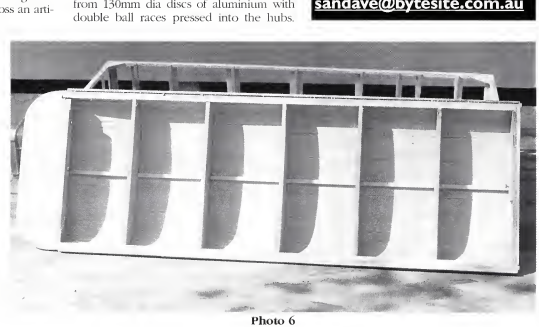
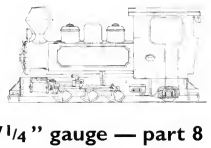


Photo 6

Bunyip



A Bundaberg Fowler 0-6-2T in 7¼" gauge — part 8

by Ian Smith

Drawings and photos by the author unless credited otherwise

Motion brackets

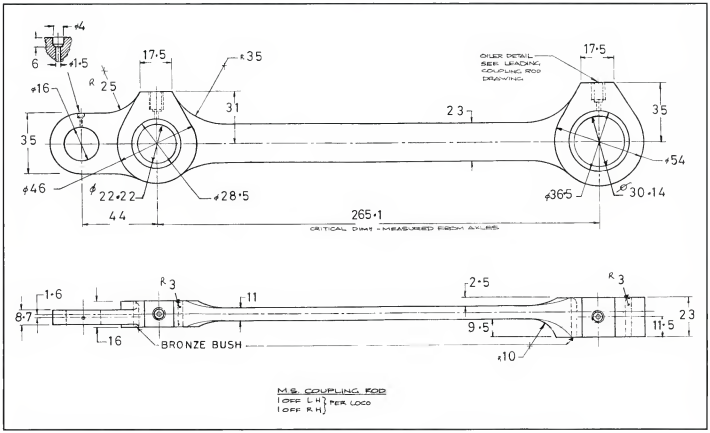
The motion brackets are right and left handed iron castings. Machine the castings as follows. Clamp an angle plate at right angles to the milling machine travel, clamp the bracket to the angle plate with the two bearing pads to the angle plate and with the bracket bolting face vertical so it can be machined — it can be bolted through the rectangular hole. Do not completely cover the hole as you will need to take a measurement from it. If the angle plate is 180mm high, rest the under side of the casting on top of the angle plate, if not pack with parallel strip, taking light cuts of the face, machine off the face till the centre of the slot is 96mm (from the face), the same as the cylinder centre.

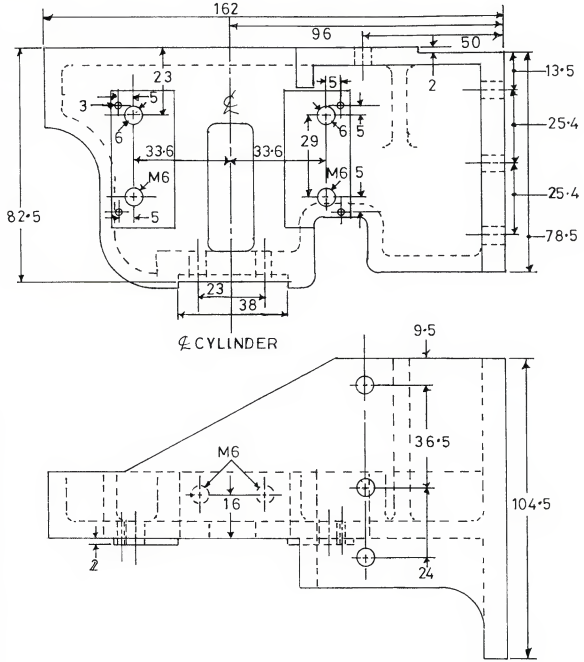
Clamp the machined face to the angle plate with the two bearing faces up, sit the under-side of the bracket on parallel strips and machine the bearing pads until they are 2mm height, rotate the bracket 90° and machine off the top pad. Take the cut to the end of the bracket until it measures 86.5mm over the bracket, come back to the corner of the bolting face, take another cut 2mm deep x 30mm wide, parallel to the bolting face. Using a protractor set the bearing faces to 3½° with the bolting face still clamped to the angle plate. Now the slide bar slot can be machined 38mm wide with the centre of the slot 96mm from the bolting face and 82.5mm from the top face to the start of the taper. The taper in the bottom of the rectangle slot is filed in when fitting the radius rod for clearance through the hole.

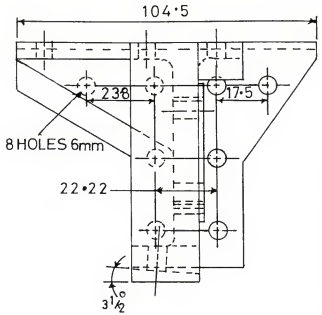
Fitting the expansion link brackets

To mount the expansion link brackets on to the slide bar bracket, the set up is to measure the width of your expansion links (they should be 38mm), make a spacer out of BMS 25mm diameter x 38.1mm wide with a 12mm bore. With a Vernier height gauge, mark the centre line around it 19.05mm (the line is there to set the expansion link brackets up to the cylinder centre line), machine up two spacers 48.7mm long (these are used to set the centre height of the expansion link brackets).

Turn the bracket up side down on the milling table, thread a 12mm rod through one bearing then the 38.1mm spacer and the other expansion link bracket. Make sure they are right and left hand and the small steps on the boss face towards each other. Clamp the three together, lay each end of the 12mm rod which is sticking out each end of the expansion link brackets on a 48.7mm spacer, the oil hole boss facing down. From the bolting face of the bracket, set the centre line on the 38.1mm spacer to 96mm, clamp the expansion link brackets to bracket, take off the clamp that is holding the two brackets and spacer and see if the 12mm rod will rotate freely. If so, drill 5mm hole using the radius bracket as a drilling jig, and open out to 6mm, fit a neat fitting bolt in the hole and clamp tight. Remove the clamps holding the brackets and repeat. If you can not get a drill in to drill the other hole, make a 5mm pin punch and mark the centre, remove the brackets and drill 5mm and tap M6. Open out the other bolt hole to







MOTION BRACKET
1 OFF RH
1 OFF LH

6mm, make two 6mm studs and screw them into the bracket, and mount the two brackets on to the bracket and see if the 12mm rod will still rotate.

Mounting to the frames

Now to mount the brackets on to the frames — they are on the outside and in line with the number one stretcher, with the mounting pads for the radius link bearings facing to the rear of the loco. Clamp the bracket to the under side of the overhang of the stretcher and measure from the centre of the horn blocks to the bearing mounting pad face. Set it to 140mm and using the same drilling arrangement as you did for drilling the cylinders, start with a 5mm drill and open out to 6mm. The M5 holes can now be drill and tapped from the top of number one strecher. You can now fit the radius links and bearing to the brackets and see if they move freely.

Coupling rods

These are machined from two pieces of MS 65mm wide x 25mm thick x 360mm long, and two pieces of MS 55mm wide x 20mm thick x 280mm long. First off, before machining the rods, make up two dummy coupling rods from material 50mm wide x 12mm thick x 310mm long, and in one end machine a 30.1mm hole a nice sliding fit on the driving wheel crank pin, and another at 265mm apart. Drill and tap M6 through the side into the 30.1mm holes and make an eccentric bush to fit the 30.1mm hole with a 22.22mm bore to fit one end. Lift the frames so the wheels are off the bench and able to be rotated and fit the 30.1mm hole on to the driving pin and the eccentric on the other. With the dummy rods on each side, set the eccentric bushes so the wheels rotate with out binding, clamp the eccentric bush with a M6 cap screw so it will not move and mark which one is right and left hand so they do not get mixed up. Check the centre distance with a Vernier and mark out the shape of the coupling rod using the reading you got from the Vernier. Cut out the outside shape of the coupling rod, mill the 360mm long rods to 23mm thick, then mill the other end to 16mm for about 90mm. I cut the 25mm and the 35mm radius with a flycutter. Clamp the coupling rod parallel to the milling table travel on parallel strips and with the 23mm thick end come in 27mm from the end and 27 mm from the bottom and drill and bore to finish size of 36.5mm, repeating on the other rod. Turn a bronze bush a press fit in the rod, 36.5mm with a bore of 30.14mm running fit with a 3mm radius in the bore in one end. Make sure you press it in the right way around, the 3mm radius goes to the back of the rod, all the bushes will have radius in one end. Turn a pin 30.14mm diameter, long enough to go through both rods for setting up the next bore in the coupling rod. Reclamp the rod on to the milling table parallel to the milling table travel and with a finger dial indicator, set the center of the bore, lock the cross travel and wind the table along 265.1mm. Sit the correct hand dummy coupling rod on top of the rod and insert the 30.14mm pin through both rods (**Photo 1**) With a finger dial indicator clock up the bore (**Photo 2**), move the table travel till the bush in the dummy rod is centred, lock the table travel, remove the dummy rod and drill and bore this end to size 28.5mm (**Photo 3**). Move the table along another 44mm and drill/ream 16mm. Repeat the same on the other rod. Make another two bronze bushes 28.5mm diameter a press fit in the bore of the rod and 16mm long with a 22.22mm bore

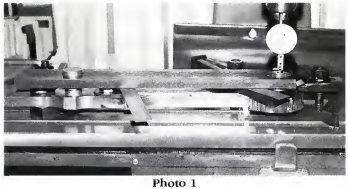
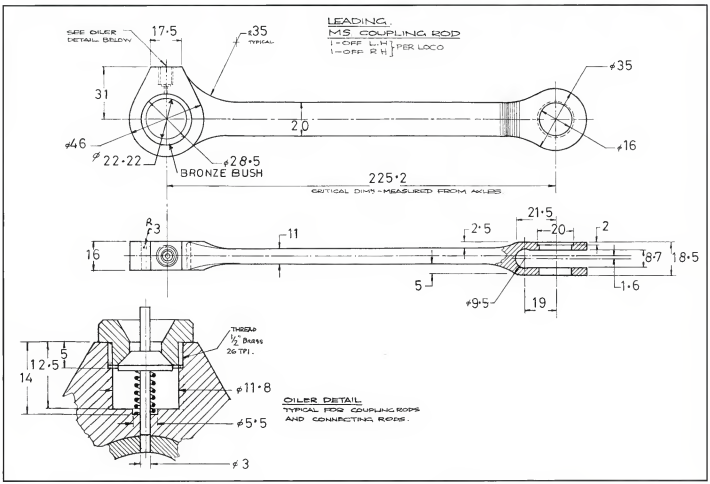


Photo 1



and a 3mm radius one end, fit the rods to the crank pins and rotate the wheels — they should turn freely.

Clamp the coupling rod back on to the table parallel to the table travel and machine the 9.5mm step (**Photo 4**). Make sure you leave enough material for the 10mm radius in the corner around the end bosses. Reverse the rod on the table, sit the 16mm end on a 7mm spacer so the rod will be parallel and machine a 2.5mm step (**Photo 5**). You should have an 11mm thick shank. Before removing the rod from the table, the pivot end of the rod can be machined to size. Machine a step 5.2mm deep x 35mm long — do not cut in to the 10mm radius on the boss — reverse on the table and machine till the tang is 8.7mm thick and repeat on the other rod. **NOTE the tang is 1.6mm off centre**. Make two filing buttons 35mm diameter x 5mm long with a 16mm bore and using a short length of 16mm BMS fitted through the 16mm reamed hole, with a filing button on each side, shape the end of the rod.

Make two bushes to go into the 30.14mm dimeter hole in the dummy coupling rod with a 22.22mm diameter bore to fit the crank pins on the coupling wheels and repeat the same procedure as for the driving wheel and coupling wheels. To machine the leading coupling rods follow the same procedure as for the main coupling rods — the only difference is this one has a slot cut in it to take the tang of the main coupling rod. Machine the rod to 18.5mm thick and then machine the boss end to 16mm thick x 60mm long, rotate the rod on the milling table 180° with the step down on the table and clamp. Drill and ream a 16mm diameter hole in the 18.5mm thick end, 18mm in from the end and 23mm from the side. Counter-bore the 16mm hole to 20mm diameter x 2mm deep. Before machining the rod to shape rotate the rod 90° and hold in a vice and in the 16mm hole end, drill a 9.5mm diameter hole, 9.5mm in from the counter bore side of the rod, and 36.5mm in from the end of the rod. **NOTE the slot is 1.6mm off centre**. The 8.7mm wide slot is cut into it using an 8mm wide side and face cutter. Now the rod can be machined to shape and the shank to size. Using the filing buttons, shape the end of the rod. The slot can now be cut in the end — either clamp it in a milling vice to machine the slot or clamp on to the milling table on parallel strips to machine the slot.

Clamp the main coupling rod on parallel strips, parallel to the milling table travel, then fit leading coupling rod to it with a short length of 16mm BMS pin to couple the two rods together. Then set the leading rod parallel to the table travel on parallel strips, clamping the boss and using the finger dial indicator, find the centre of the 22.22mm hole. Move the table along 265.1mm, with a 22.22mm pin fitted through the dummy coupling rod and main rod, find the centre with the dial indicator and lock the table travel, remove dummy rod and drill and bore to 28.5mm diameter the same as before. Repeat on the other rods.

To machine the 10mm radius on the coupling rods set up the rotary table on the milling machine. Make a pin to fit the centre of the table and long enough to go into the coupling rod ends. Start with the largest size and when they have been machined, turn it down to the next size, find the centre of the rotary table. Move the cutter away from the pin, mount a 20mm ball nose end mill and carefully machine the radius on the boss to size and shape (**Photos 6 and 7**).

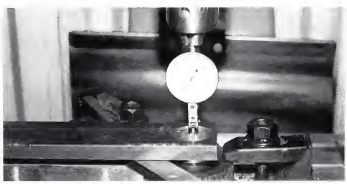


Photo 2

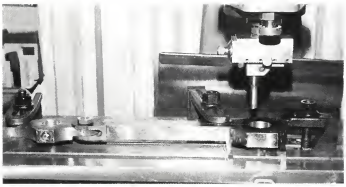


Photo 3

Photo 4

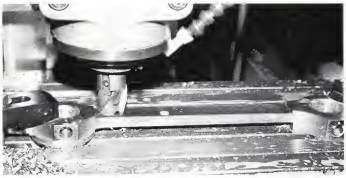
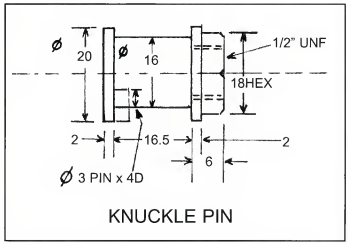


Photo 5

Photo 6

Photo 7

To finish the rods make the holes for the oil cups and knuckle pin. The oil hole for the knuckle pin needs no explaining just follow the drawing. The spring loaded oil cups holes are fist drilled 3mm diameter right through, then opened out to 5.5mm diameter to 14mm deep flat bottomed, then opened out to 11.8mm diameter flat bottomed to 12.5mm deep and tapped 1/2"BRASS to 8mm deep. Draw file and polish the coupling rods before fitting (**Photo 8 and 9**).



KNUCKLE PIN

Knuckle pin

The knuckle pin for the coupling rods is a simple turning operation. Mount a piece of 20mm BMS in the three jaw chuck, turn it down to 12.7mm x 6mm and screw cut 1/2"UNF, under cut the thread at the shoulder so the nut can clamp on to the step then turn to 16mm diameter x 16.5mm long. Before parting off 24.5mm long, try the pin in the leading coupling rod — the rod should only just rotate on the pin with a nut and washer locked tight. The nut and washer is machined in one piece. Using a short length of 20mm bar, drill 11.5mm diameter for 10mm deep and tap 1/2"UNF in each end. Set up the dividing head on the milling machine and machine an 18mm hexagon 4mm long, return to the lathe, chamfer the end of the hexagon and part off 6mm long. Chamfer the threads to give a nice finish to the nuts. The last thing to do on the pin is to drill for a 3mm locking pin against the shoulder, 4mm deep, cut a piece of 3mm diameter silver steel pin 6mm long and fit to the knuckle pin. You will have to file a keyway 3mm wide in the rod where the pin goes and only in the counter bore side.

To be continued ...

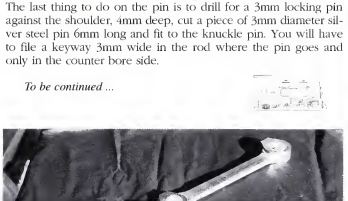


Photo 8

Photo 9

A Statement of Clarification From the AMBSC

It has become increasingly evident that some aspects of inspection of miniature hobby boilers have been misinterpreted. In order to reduce that ambiguity, the AMBSC executive has conducted enquiries and discussions, and arrived at the following determination. This statement is intended to assist club boiler inspectors in the pursuit of their charter to help club members, and to protect all members of affiliated clubs in their participation in the hobby.

"AMBSC listed club boiler inspectors shall not accept requests for approving or re-testing of boilers which exceed AMBSC Codes".

This position is referred to in clause 1.1.2 of AMBSC Code Part 1 (Copper) and clause 1.1.2 of AMBSC Code Part 2 (Steel).

The existing AALS insurance cover does **NOT** extend beyond the limits of AMBSC Codes Parts 1 and 2, which means that both the inspector and the owner will have no insurance cover *for the boiler* under the existing AALS insurance policy if over-code boilers are inspected.

Furthermore, at this point in time, miniature hobby boilers are defined in clause 1.1.2 (in each Part) as having definite limits as follows:

- **for steel boilers**, a maximum capacity of 50 litres, AND a maximum mean barrel diameter of 14" (355 mm), AND a maximum design pressure of 100 psi (700 kPa)
- **for copper boilers**, a maximum capacity of 25 litres, AND a maximum mean barrel diameter of 8" (203 mm), AND a maximum design pressure of 100 psi (700 kPa)

If ANY ONE of these parameters is exceeded, the boiler is outside the scope of AMBSC Codes.

This statement includes aspects of the Codes and insurance as they stand at **June 1999**. Any subsequent variation to either will be considered and, if necessary, new statements will be issued.

The question of externally inspected boilers operating on AALS club affiliated sites is still being investigated, as there exists some ambiguity over multiple (but separate) insurance policies operating in the one general area. Additionally, there seems to be a "grey" area between the upper limit of AMBSC, and the lower limit of Workcover (in NSW). This too is being further investigated. Clarifying statements regarding both these matters will be issued as soon as they are resolved.

For AMBSC,

Ian Kirby (Chair)
Mark Watkins (Secretary)
Ross Forsyth (Tech Officer)

Bay Watch!

Ideas for the design and safe operation of steaming bays — part 3

Story and photos by Roy Smith

Entrance/exit roads

Two tracks for separate entrance/exit routes such as Wagga has, will give faster throughput, particularly if one track is blocked whilst someone is waiting for the road or experiencing problems.

These roads should be fairly long so that any drop down to main track level isn't too severe and there should be a level section at the turntable end (where you can get safely onto your loco) and another before the junction with the main line (so you can wait while you ring in to the signal box to notify your presence). For true safeworking, a set of catch points should be installed between the departure signal and the junction points. That'll sort out the firebox gazers before they get onto the track!

Similarly for the arrival road(s): you need enough track length so that when things get very busy, you can safely queue locos clear of the main line whilst they are dealt with through the disposal routine.

Steam v. diesel accommodation

As the full size found out, diesels and electrics don't survive well in the harsh environment of steam sheds. These locos don't seem to require raised bays in most cases and are more easily stabled than steam locos in sidings where they can be simply switched off, handbrake applied, and left while you go have lunch.

Requirements for I.C. and electric locos

Talking of separation, the main requirement is that petrol locos can be safely refuelled away from potential inflammable vapour ignition sources (and that also includes electric locos — switchgear, particularly for DC, causes arcing). Petrol vapour is extremely volatile and the petrol should be stored in appropriate containers out of the direct sun.

Battery electric locos will probably require mains voltage power outlets to allow recharging unless the club has a big central charger. It's not really recommended sharing a charger concurrently between more than one loco though. Battery locos are not immune from the requirement for isolation when being recharged as the cells will produce inflammable hydrogen gas, particularly when overcharged or charged too rapidly.

Basically, make sure that internal combustion and battery locos are kept well away from steam locos when being serviced. Similarly, electrical equipment doesn't function all that well when full of steam condensate or smoke!

Wagga's bays are adjacent to the public area and while the public are safely on the other side of the fence, they still have a good view of the interesting activities. I believe this 500 class loco came over from South Australia to be based at Wagga, but I have not seen it for some years — can anyone tell me what's happened to it?

Materials store

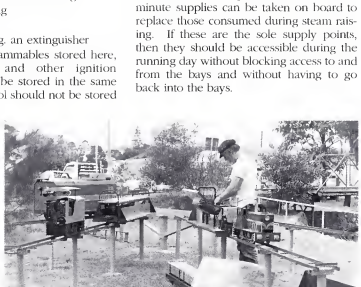
A useful adjunct is a small, secure shed near the bays containing:

- oils, steam and lubricating
- hoses and hose fittings
- water treatment
- a battery charger
- basic tool kit
- hand cleaner and rags
- a container of dry kindling
- a bottle of kero to soak kindling
- axe to cut kindling
- firelighters
- fire fighters — e.g. an extinguisher

With all the inflammables stored here, matches, lighters and other ignition sources should not be stored in the same building. Also, petrol should not be stored near steaming bays.

A wood store is also handy to keep bulk supplies of dry lighting up wood. Char and coal supplies are usually kept in purpose-made bins that often go some way to emulating a full size coaling plant. Smaller locos go better on smaller sized chunks of fuel — there is less open air space around the pieces of fuel and a thinner firebed is possible (remember, fire 'little and often' — some people forget the 'often' when their loco is working hard!). A fuel crusher is a nice accessory to have if the club is interested enough to supply different sizes of char or coal.

Char, coal and wood supplies should be easily accessible to those folk who require fuel for steam raising in the bays. A char/coal bin and water crane could also be situated near the departure road so that last minute supplies can be taken on board to replace those consumed during steam raising. If these are the sole supply points, then they should be accessible during the running day without blocking access to and from the bays and without having to go back into the bays.



Newcastle has taken the trouble to provide a separate diesel and electric loco servicing bay area

Reticulation of services —

Power

Each bay should have a power source for blowers — 12 volt dc and/or compressed air depending on the club's inclination. The 12V is easy to reticulate and connect to — it is also fairly universal. For longer bays, the terminal box should be somewhere close to the middle of the bay and the terminals should be protected from moisture and falling metal objects.

If you have 240V ac outlets, then they should be installed as per the electrical rules: away from water/steam sources and preferably with hinged covers over the outlets. Dragging mains extension leads around steaming bays is not recommended. I have seen 240V blower units but these are definitely risky in the steaming bay environment — they should be properly earthed if used.

Air

Some folks prefer to use compressed air but it often means having to have a range of adaptor fittings on hand to suit different outlet types. The compressor shouldn't be too far away from the bays and should have a reasonable size line from which smaller branches then go to each connection point. You need to be able to drain condensate from the line also.

Water

At least every second bay should have a tap and hose for watering. Hoses and electric wires dragged over to adjacent bays are bad enough but under (or over!) further ones is just plain dangerous.

Some tracks have both plain and treated boiler water available — water tanks, columns and taps should be clearly marked as to what they are supplying.

Keeping the public at bay!

Let's face it, steaming bays are very interesting places, usually with lots happening during steam raising and they're the best place to see the locomotives close up. However (and it's a big however), steaming bays can be dangerous places to the inexperienced and over-curious, particularly the young.

I have been to tracks where young kids wander round the bays and want to be part of the action — they'll try to help by pushing things around but have little idea of the dangers involved or the safe way to do things. Dads, Mums — please keep your kids out of these areas.

So there are contradictory issues: on one hand, what a great public relations drawcard — let people watch and nurture their interest and maybe we'll recruit some new members. But for their safety, keep the public at a safe distance, outside the fence! That's why Railways staff are quick to eject anyone caught trespassing in loco depots.

A couple of club members I have discussed this with have suggested that an alternative could be for a responsible club member to escort up to three members of the public at a time, though the bays. This may be feasible during quieter running days but I doubt there will be enough members with the time available for such a task during major runs.

Busy times at Wagga Wagga — a good illustration of the value of having a Chargeman to co-ordinate everything.

One problem with ground level bays is the provision of water and power. Eric Evans and Lloyd Dannenberg raise steam in their BB18¼ and PB15 locos by using a large mains powered transformer and rectifier unit to supply 12V for their blowers (Penfield 1991 Convention)

Supervision

One person (the Chargeman) should take responsibility for the running of the bays. This individual should be responsible for:

- Safety!
- Control of all movements around bays including turntables/traversers
- Allocation of space on bays (whiteboard or chalkboard)
- Provision of supplies — oil, fuel, water, power, etc.
- Control access to bay area to ensure that only people actively engaged in steaming a locomotive are permitted in the area.

During busy runs (eg. convention/invitation), he may have assistants to whom are delegated certain duties and are responsible to him alone! In the mould of the true railway Chargeman, he should have a loud voice, a thick skin, a degree of long sufferance and the ability to keep calm under a lot of pressure.

Steaming bay functions

Up to now, I've talked about how to design and equip steaming bays. Now I'd like to concentrate on how best to operate this important facility. There are a certain group of functions or activities performed in or near the bays which are intrinsic to the safe operation of locomotives. The design of the bays should reflect these.

Signing on for the day!

Even though this is a hobby, at my home club, I still start my day (even before

unloading the loco) by signing on for insurance cover purposes — at least there's no grumble-bum timekeeper watching the clock — and then I'll check out the notice board to see what the per-way and signalling fellas have been up to since I last ran. Not too many clubs seem to have a central notice board at their track though.

Then I check the Bay Allocation board to find which bay has been allotted for my use. If my name and loco number is not shown (for whatever reason — usually because I can't guarantee I'll be running on a particular day), then it's time to approach the Chargeman to get a bay allocated and he will then put this on the board. Now, and only now, is it time to shunt my trailer onto the unloading pad.

Unloading

I have gone to a lot of trouble to set up my trailer so that one person can easily unload the loco but lining the trailer up to the traverser is much easier if someone can give directions. It only needs one person to assist in this way — so many times I have seen everybody in a group calling out different directives, or calling out the same one but at different times. Very frustrating, very confusing and really, quite dangerous! I won't go into details but our club learnt the hard way!

Now, if things are not too busy, the Chargeman will oversee the unloading operation but if he is otherwise occupied, his nominated assistant — "Hey, Yoooouu!" — (Jock, our Chargeman fulfils all my earlier criteria) will take over the task. After the loco is freed from its fastenings, he assists with pushing the loco onto the traverser and as he does, casts an eye over the loco to look for any obvious defects. If he sees anything untoward, the loco will be Red or Yellow carded (he's a soccer fanatic). A Yellow card will allow the loco onto its allocated bay for running repairs but a Red card will mean either a shunt into the workshop road or back onto the trailer! The loco will not run until repairs have been completed to his satisfaction.

This used to upset a few people but we quickly learnt it was for our own benefit. As Jock says: "Nae brakes — nae running!" All this came about in the early days because one person assured us that he had brakes on his loco. Only after a very hard rear-ender did we realise that he had neglected to tell us that his brakes weren't working. I don't think he's been back since Jock offered to demonstrate where he should stow his fire-irons.

Whenever a member of another club turns up, our Chargeman will notify the Boiler Inspector to have both the Boiler Certificate and the boiler itself checked. If all is well, another member will give the guest a short guided tour of the facilities and answer any questions about running regulations and signalling.

Finally, have you noticed that the arrival of any large or unusual loco at the gate will draw a small crowd? Please fellas, give the owner plenty of space to safely unload. There will be plenty of time to look over the new arrival during the day.

Steam raising

Before lighting up, it is important to inspect the condition of the firebox and smokebox. Look carefully for the following:

- Are there any signs of leakage around tubes, stays or seams?
- Are any plates bulging?
- Is the grate properly in position and secured?
- Is the ashpan clean and door(s) secured?
- If you have a spark arrestor, is it clean and not choked?
- Are the tubes clean?
- Is the smokebox door properly closed and sealed?
- Is there any evidence of scorching on the lower part of the door?

My club doesn't have any tame steam-raisers to do the work so we have to get our own issue of wood and char (or coal) and set the fire ourselves after making sure that there is sufficient water in the boiler! A number of people have made mention, when seeing me use chemical fire-lighter blocks, that I'm cheating because the real railways didn't use them. Well we did — in a fashion. We used paraffin-soaked rags and tipped waste oil over the firewood and believe me, if the railways had issued fire-lighter blocks, we would have used them, particularly when the lighting up wood was wet or green.

Similarly, the use of external blower fans or compressed air for steam raising was not unknown — certainly, it was frowned upon because the accelerated rate of steam raising possible with these techniques strained the boiler and could lead to leaking tubes or worse, firebox fractures, particularly in the ligaments or stays.

Raising steam is smoky business and although the public like to see what's happening, I find that smoke can be more of a nuisance to crowds and in these days of Occupational Health and Safety, will become a bigger problem. Until the fire reaches a temperature that will permit complete combustion, smoke will be produced and the artificial draught blowers will direct that smoke according to direction of outlet nozzle only as far as prevailing wind direction and strength will allow. Murphy's Law of Lighting Up states that the smoke will follow you wherever you try to oil round.

The smoke produced by firelighters, kero and even some species of timber kindling is an irritant to respiratory passages — another reason for keeping the public at a safe distance and limiting access to the bays to only those directly involved. Similarly, coal will produce brown/green smoke if temperature and air supply is not sufficient for complete combustion.

There used to be an abrasive powder called 'Kzit' (pronounced 'Exit') which was used to keep the tubes clean (plain sand was used on oil burners). This stuff had an interesting side effect of turning black smoke white a few minutes after being sprinkled on the fire — very useful when the smoke inspectors were about!

The job of oiling round is performed while 'the kettle is boiling'. In steam days, oil was always issued by the stores reluctantly — as if it was liquid gold. There were always economy drives to reduce consumption and we learnt to oil round with a minimum of spillage. Less oil around the running gear meant less for the dirt to stick to and this is just as applicable to our models. Don't over-oil the motion — most models don't have plugs or caps to prevent oil being thrown out as the rods do their thing. Wipe off any excess and beware of dropping oil onto other peoples' kit under the bay or onto the ground where it can mix with water and become quite slippery.

This is the time for your final inspection. Drivers never took this task lightly —

Eric Evans blows down the boiler of his BB18¼ on the Penfield pits. Notice how the side discharge is blocked by the bay wall — imagine what would happen if this was done in a crowded, unprotected elevated bay.

if they missed something, it could be the difference between making their destination on time or being stuck miles from anywhere. This reminds me of a bit of footplate wisdom: if a steam loco broke down, it took three minutes to work out was wrong and three hours to fix it. With a diesel, it takes three hours to work out why it won't go but just three minutes to change the fuse.

Boiler water treatment and blowing down

I would like to spend a little time discussing this important part of boiler operation because it's not fully understood — in fact, it's widely misunderstood.

All natural water contains suspended and dissolved matter, the most common being the acid salts of magnesium and calcium. Treating boiler feed water brings about the precipitation of these scale-forming salts which causes the resulting suspended matter to be readily removable as a sludge. This helps keep the firebox plates and tubes in a much cleaner condition than is the case when untreated water containing scale-forming salts is used. The type and quantity of treatment depends on water quality and this can vary widely across districts. Too much treatment can be as bad as not enough — it will make your loco prime and/or foam and destroy the lubricating film in the cylinders.

Blowing down the boiler regularly helps clear the lower portions of sludge buildup that will cause scale as well as discharging soluble salts that can lead to priming. The process should be carried out in a regular and systematic manner to prevent foaming and priming which impairs the boiler condition and can damage the valves and pistons by washing away the lubrication.

Many Queensland locos were fitted with Scum Cocks — these were valves mounted on the backhead with a pipe into the boiler steam space roughly where the water level was when at approximately half a glass. The cock was opened periodically when steaming hard and this drew off any scum and foam from the surface of the water. Doing this regularly reduced the risk of priming. New South Wales fitted a continuous blowdown system to virtually all locos from the 36 and 57 classes onwards with, if memory serves me correctly, the major exception being the American 59 class.

There is also a misconception that copper boilers don't need as much boiler treatment and blowing down as steel vessels. What really decides this is what's in the water, not what your boiler is made out of. A fine layer of scale on the water side of the tubes and firebox heating surfaces will do more to retard heat transfer than a build up of soot on the fire side. Additionally, the insulating effect of scale on the water side will lead to overheating and burning away of the fire side, particularly with copper tubes and plates. So you can see that although copper boilers do not rust, they are still vulnerable to damage if not cared for!

Diamond Valley's shed Departure and Arrival roads. The raised section in the foreground is for fire dropping and de-ashing — the blowdown pit is next along the road before the turntable is reached. Water is easily obtainable for departing locos

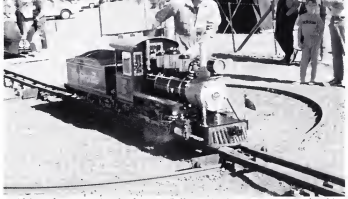
As a general rule, blow down before entering traffic and immediately after pulling out of traffic — if necessary, also periodically during the day, depending on water quality. It should be done with at least half a glass of water blown down to a quarter of a glass but feed water should not be injected into a boiler just prior to blowing down unless the water level is below half a glass or the fire has been dropped and the whole boiler is to be emptied.

A final word of wisdom — always test injectors and hand pumps before going into traffic. It helps knowing that your injector(s) works reliably before blowing down — if it doesn't, you haven't got much water left above the crown, particularly if you inadvertently blow down to less then a quarter of a glass. Prepare to drop your fire — never inject cool water into a boiler with an overheated crown sheet!

Where to blow down? Preferably on a special road: e.g. the departure road away from the bays or on a special bay close to the departure road so that others aren't held up. Similarly, when coming out of traffic the ash pit road could be used but beware of ashes being blown around by the discharge. It is preferable that a special pit be installed on the ash pit road but separated from the ash pit area itself (such as the ones at Penfield and Diamond Valley).

Blowing down can be dangerous to unwary bystanders or even knowledgeable people if carelessly carried out. Care needs to be exercised as the position of blowdown valves and nozzles varies between locos — some blowdown to the side and some underneath. Both must be catered for. Bottom discharge will be comfortably catered for with a pit but side discharge must be prevented from spraying the countryside and everyone nearby.

Don't blow down in the bays if there is any chance you'll cover kit, toolboxes and supplies on the ground below with condensate if not also soaking people and locos on nearby bays. This is not good for your popularity!



Although a very simple design, Tullamarine's temporary 'outback' turntable for the 1998 Convention did the job for over five years and was still present for the 1992 Convention

Going into traffic

The process of departing from your bay starts before you actually move your loco. Firstly, the Chargeman should be informed that you are ready to move out. He will organise the turntable or traverser and set the road by having the turntable/traverser set correctly and locked in place. Before charging out, have a look around to see if your departure is going to

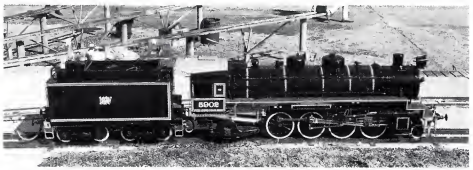
inconvenience your neighbours — are they going to get sprayed with cylinder drain condensate? If so, just use a breath of steam to start heating your cylinders and push your loco out by hand until it's clear of others.

As mentioned earlier, once you are on the Departure track, it is handy if you can top up your water and fuel supplies if it was not possible to do so whilst on the bay. Full size sheds always allowed for topping up the water (if not also the coal) and blowing down the boiler as part of the departure procedure. Ensure that your fire is in good condition.

Finally, notify the signal box that you are ready to enter traffic and await the setting of the road and the signal being cleared.

Coming out of traffic — de-ashing

Ideally, your bays should have one or two arrival roads which allow fires to be dropped and ashpans to be emptied before proceeding to bays. There should be a hose adjacent to quench dropped fires and cool down dropped grate sections and pins for retrieval (lest they be forgotten and lost in the ash). A couple of places I have visited have a separate blowdown/de-ashing road or area: Penfield is one, Diamond Valley is another — but during big meets, such facilities may be insufficient to cope with demand. Having the de-ashing facilities somewhat away from the bays will assist greatly in keeping the bays drier and cleaner — that should keep the O H and S people and the Chargeman happier! But if no special site is available, a small barrow can be pushed under a bay when the driver wishes to drop the fire. However, keep an eye out for ash and lumps of fuel dropped from the fires after previous running days. If the ground is hard, or concreted, such lumps can be a safety hazard under your feet, particularly as the ground is usually wet around bays — goes with the territory! Best to sweep the bays out after each running day.



Lyle James beautiful 59 class sits on one of the two unloading roads at Newcastle. The duplication of tracks on the pad speeds up the unloading and loading throughout and reduces the traditional bottleneck experienced at this point in most steaming bays

Above and below: Penfield has a three track 'elevated bay' section amongst all their mainly ground level bays. In the forground (above) is the de-ashing pit

At least bays are generally well drained unlike the full size pits where one descended into the dirt, ash, oil, water and whatever else accumulated in the poorly lit cess ponds. However, oil dropped onto a concrete surface can be very slippery, especially when there is also water lying around.

Steam cleaning

After coming out of traffic, I've seen a few people take the trouble to use their residual pressure and water to steam clean their locos. This should be done with great care as you are releasing a great deal of energy via a flexible hose and, unlike simply blowing down, it can go anywhere. Maybe a special bay is the way to go here — certainly, doing it inside full size sheds was frowned upon — it was preferred that it be done outside on the bull ring away from other locos and staff if no special road could be provided.

After a steam bath, rub down the loco and make sure that water hasn't got into the axleboxes. While the boiler is still warm, it's the best time to give those tubes a sweep before the soot sets hard then clean out the char and soot from the smokebox. Drain your tanks (and boiler) and give the mechanicals a good wipe over while doing an inspection at the same time, noting anything that will require repair or adjustment. Jotting items down in a repair book, as the full size used, will help you remember what has to be done. Finally, put some oil in the cylinders to prevent seizure — particularly if they are cast iron — via the blastpipe or valve timing inspection plugs.

Cleaning and packing up

This always seems to take longer than getting set up — probably by the end of the day, you're tired and want to put your feet up. Or there's still an interesting yarn to be swapped around the place. Whatever, there is still the inevitable traffic jam as most people try to load up at around the same time. Patience, consideration and co-operation are the watchwords here.

If you see hoses and other paraphernalia lying around, put them away — don't leave them for somebody else to do. Clean up the spilt fuel around the bin(s) — the stuff is not cheap, you know! Check that all the taps are turned off and not leaking. Power should be turned off and no batteries left on charge unattended. Make sure everything is put away, locked and secured, as things walk so easily these days — if you don't walk it to the shed, someone else will walk it to a new home!

So that's my tuppence worth on what is really a very broad topic. There are often as many solutions as there are many problems. But the key to it all is thinking, then planning. Then go do it! Good steaming!

The Ball Check Valve — a Contemporary Look

by Allan Wallace

There is something mysterious and fascinating about fluid flow. Compared to objects that are solid, it is intangible and difficult to visualize. It challenges our abilities to understand it because one can't pin it down, cut it into cross sections or even draw it. Yet fluid flow is as fundamental to life as our own respiration and circulation, as universal as the weather, and as ubiquitous as the humble ball check valve.

By experience, engineers have found that you cannot choose the dimensions of a ball valve at random. The proportions need to be "about right" for it to work properly. *(See AME issue 76 page 22, issue 78 page 49, and issue 81 page 55).* The consensus is that the seat diameter (Dseat) should be about D $/\sqrt{2}$ (where D is the ball diameter) and that the lift of the ball should be such that the throat area is about the same as the seat area. The throat area is the smallest open area between the seat edge and the ball.

Rules-of-thumb like this pervade practical engineering because they are simple and they work. They develop from years of trial and error and generally encapsulate an optimum between two or more conflicting factors.

Taking the Dseat = D $/\sqrt{2}$ example, if the seat is much bigger then the ball tends to wedge into the seat and jam shut. If the seat is much smaller, then the ball does not sit quickly and wobbles when it should be shut. There is nothing magical about the $\sqrt{2}$ except that it results in a 45 degree contact angle, which is aesthetic but gratuitous.

What about the guideline for ball lift? Why should we choose lift such that throat area = seat area = (for that matter, annulus area)? The annulus area is the flow area between the ball and its cylindrical housing. I think that the answer lies in a long tradition of practical engineering, where it has been understood that to minimize losses in a flow path, one keeps the speed of flow as low as possible and avoids constrictions. When the flow path has a complex shape, such as in a ball valve, we make some approximations in assessing what the flow area is. While the throat area is a point of constriction, calculating it is not trivial. For simplicity, it is common to calculate the cylindrical "lift" area (seat circumference times lift) as a guide. The plot shown in **Figure 1** compares the resulting areas as a function of ball lift. If you look closely, the throat area graph has some curvature, but the lift area graph is linear. That is a consequence of the more complex geometry required when calculating the throat

This shows that to get a lift area equal to seat area, the lift needs to be 0.175 of ball diameter. Conversely, to get a throat area equal to seat area, the lift needs to be 0.26 of ball diameter. So our two rules-of-thumb diverge by about 50% from each other. To be sure, it does not matter in our hobby, but is there a better way to choose basic dimensions for a ball valve? In these days of computer aided engineering, we have a tool that can let us look inside our ball valve and see what the flow is doing. It is called Computational Fluid Dynamics, or "CFD" for short. Just imagine that all of the water space in the ball valve is cut into little chunks like dicing a carrot (**Figure 2**). Each chunk is called a cell and it represents a tiny volume fixed in space somewhere inside the valve. We make each cell so small that the water pressure and the three velocity components are practically uniform within it. Now we look carefully at the boundaries of each cell and do some accountancy. Firstly, the mass of water in the cell cannot

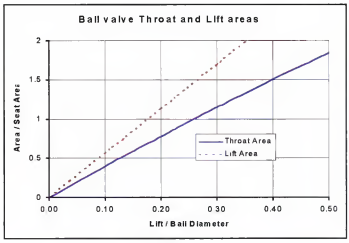


Figure 1

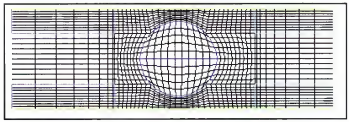


Figure 2 — Cross section of a ball valve divided into cells. Some cells are water-filled, and others are solid (such as the ball).

change (ignoring complications like cavitation and compressibility), so when we add up all the water coming in it must balance exactly all the water going out. This is the principle of conservation of mass. We also apply conservation rules for energy and momentum.

Suppose there is heat flowing into one side of the cell. That heat either has to pass out somewhere else, or the cell temperature must the rising. If the cell is at a constant temperature, then heat flows in and out must balance. In our ball valve, we will simplify matters by having the whole model at the same temperature throughout, so thermal energy balances automatically.

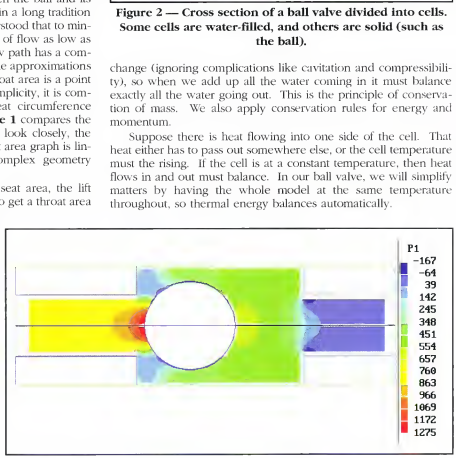


Figure 3 — Velocity vectors for water flow through a ball valve.

When we balance momentum, we relate the slight pressure differences between adjacent cells to local accelerations of the water. Balancing the books for every cell is a tedious procedure, requiring many small adjustments to the cell values for pressure and velocity. It is a task well suited to the computer. When it is all done, we have cell-by-cell knowledge of the details of the flow in the valve. That is CFD in a nutshell.

For the sake of a simple illustration of CFD applied to a ball valve (**Figure 3**), I have omitted springs and ball travel stops. The model consists of a ball in a cylindrical cavity with a hole of diameter Dseat = $D/\sqrt{2}$ at each end. The ball just stays put irrespective of the flow. You can get away with anything on a computer! I will introduce a fixed water flow rate, and repeat the simulation for the ball at various values of lift. The results from one simulation are shown in **figures 3** and **4**.

For reference, the ball diameter D = 6 mm, Dseat = 4.24 mm, Dbody = 8 mm. The ball cavity length is 11 mm and the overall length 25 mm. I have nominated a flow rate of 1 metre/sec through the inlet.

Notice how the uniform flow entering the valve impinges on the face of the ball and slides around in close proximity to the ball surface. There is an interesting little doughnut vortex in the backward-facing corner of the seat, and another, weaker, recirculation zone against the exit face. The downstream recirculation zone has a profound effect on the shape of the flow behind the ball. A ball in a free stream remote from any walls would normally have a reasonably wide "wake", a region of low-speed, recirculating and mostly turbulent flow stretching downstream behind the ball. A wide wake is generally a sign of high drag, and streamlining on cars, planes or fish etc. minimizes the width of the wake.

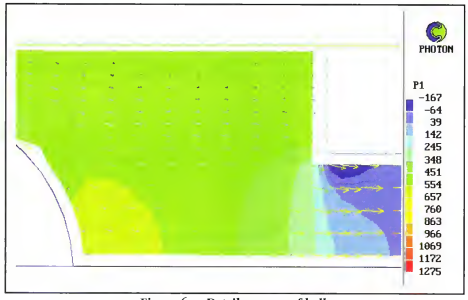


Figure 6 — Detail on rear of ball.

Curiously, the blunt, forward-facing end of the ball cavity has squeezed the ball wake almost out of existence.

The pressure contours are referenced to the exit pressure, which is set at zero. The pressure units are in Pascals (6895 Pa = 1 psi). There is a pressure build-up on the face of the ball (**Figure 4**). This is our good friend Bernouille in action. Bernouille's equation implies that as the water stagnates against the face of the ball, its pressure rises. It is a consequence of the conservation of energy. As the water squeezes through the throat, the pressure drops rapidly because the pressure energy is converted to kinetic energy. When the water passes around the ball, its velocity drops and the pressure rises again. The pressure actually goes negative as it rounds the entry to the exit hole. One reason for making the entry and exit holes the same is for the convenience of determining overall pressure drop through the valve. In this case, the pressure drop was 775 Pa for a lift of 0.23 of ball diameter.

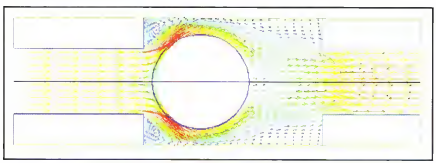


Figure 4 — Pressure contours for water flow through a ball valve

In **figures 2** to **6**, the lift area is 1.3 times seat area, and the throat area is 0.8 times seat area, from **figure 1**. On the average, the velocity across these imaginary areas would be 1/1.3 and 1/0.8 metres per second respectively. In fact, it varies from under 0.5 to 1.2 m/s.

Let's look at the force on the ball. The surface is already divided into small elements by the cells in **figure 1**. For each element, there is a force normal to the surface equal to the cell pressure times the area. Furthermore, there is a tangential force due to friction, which we can ignore for now since it is insignificant compared to the pressure forces. Simple trigonometry at each element resolves the pressure force into the component parallel to the valve axis, giving a drag force. To get the overall drag force on the ball, we sum the contributions from all the elements. Now here's a surprise - in this case the drag force is negative, and the ball is being sucked towards the seat!

Can this be real? Look closely at **figures 5** and **6** and you can see a small high-pressure zone on the face of the ball. This is region contributes a strong downstream push. But at the cheeks, due to the local high velocity, we have the lowest pressure anywhere in the valve: that is a strong suck upstream. At the back of the ball, the pressure has recovered somewhat and this area is also pushing the ball upstream. The net result is that the negative drag forces more than cancel out the positive drag forces. Intriguing!

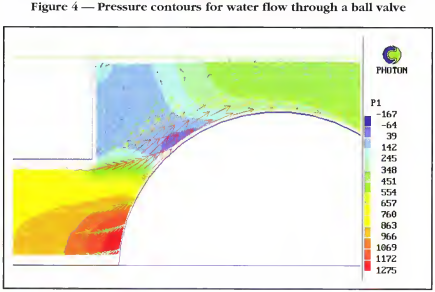


Figure 5 — Detail on face of ball

If there are no net drag forces, then the ball does not need to be held in place and it should sit there without support. We have all seen the kids' toy where you blow through a tube with a flat disk on the end. A flat wheel with spinner blades can be placed on the disk, and far from being blown off, it sticks there and spins.

Convinced? You have every right not to be, because in reality, the ball has only to wobble a little and the delicate balance is disturbed. As it turns out, the suction effect occurs only over a limited range of lift. I think that the ball will always end up on its travel stop. However, I have come across valves that rattle at certain flow rates, and a phenomenon such as this could provide a plausible explanation. CFD is a remarkable tool for discovering effects that are difficult to diagnose by experiment.

I ran the above simulation with the ball at varying lifts, calculating the drag in each case.

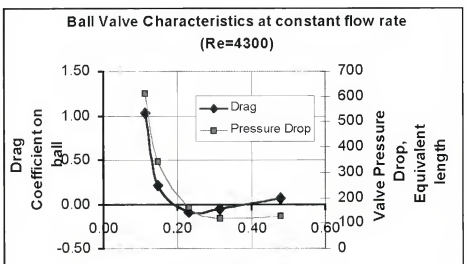


Figure 8

Figure 8 is a graph of drag versus lift (diamond markers). The drag force is expressed as a drag coefficient for reasons I shall give later. As one would expect, the closer the ball is to the seat, the higher the drag force on it. The suction zone is where the drag curve goes negative between L/D = 0.2 and 0.4. The shape of this curve will clearly change with the proportions of the valve cavity.

Expressing drag as a coefficient rather than as an outright force is a useful device that has always been used by engineers, because it extends the application of the data to other cases where the sizes or flow rates are different. It is also known as non-dimensionalizing the data, because it makes the graphs applicable in any system of units. A good example is the familiar Lift / Ball Diameter. It does not matter if you measure in inches or metres. When lift is expressed as a ratio, the number is universally applicable. Similarly, the drag coefficient is a ratio between the drag force (in pounds, Newtons, grams or whatever) and some reference force (in consistent units). In this case, the reference force I have adopted for the drag coefficient is the product of the inlet dynamic pressure (= half fluid density times velocity squared) and the seat area. Its physical significance is that it represents approximately the total force on the nose of the ball within an area defined by the seat contact ring. The beauty of the non-dimensional drag coefficient is that, with a few caveats, the plot on **figure 8** is applicable to any fluid and any speed in a valve of any size.

The other plot on figure 8 is the net pressure drop across the valve. Again, the pressure drop is non-dimensionalized so that the data is applicable to any fluid, flow rate or valve size, and is available in any system of units, metric, imperial or whatever. This time, the reference pressure is the pressure loss through a pipe of length and diameter equal to the seat diameter. For this reason, it is known as an equivalent length. For example, at a lift / diameter of 0.2, the pressure loss through the valve is equivalent to the pressure loss through a length of pipe with a bore equal to the seat diameter, and a length 220 times its diameter. Of course, in a boiler feed check valve, we are not too concerned about the pressure drop, but it may be important for a pump inlet valve, and it is very important in a safety valve.

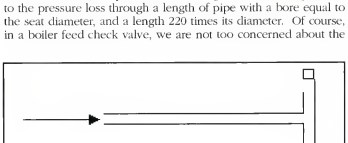


Figure 7 — A spinner stays on the disk, despite the air tending to blow it off

Notice that the drag and pressure drop curves have a similar shape? It is a sign that the majority of the pressure drop is caused by the ball. Well, I guess we knew that.

There is a tendency these days to put too much trust in the computer model. Software vendors are particularly to blame, with glossy coloured images and appealing promotions. Someone with the training to know roughly what the answer will be should scrutinize every computer simulation. Some validation can take the form of simple consistency checks. For instance, the ball valve model above must predict that the mean exit velocity is 1 metre per second, as it was for the inlet of the same cross-sectional area. In my opinion, the best validation is to run an experiment if possible. Often scaled-up or scaled-down experiments are feasible. With suitable scaling laws, one can substitute air for water, glycerin for molten glass, water for liquid mercury, air for superheated steam and so on. I commonly use CFD to model the experiment rather than the reverse (because it's easier to change software), and then proceed with a calibrated computer model.

Despite the marvels of computer aided engineering, there is a very long way to go before we can reliably predict phenomena like ball chattering. Far from being nicely static, as my model has assumed, the flow field is a complex of interactions, constantly and randomly changing with time. What happens when the ball spins, or there is swirling flow at the inlet? How about compressible fluids, such as steam? We may consider the slide rule as quaint and crude, but future engineers will no doubt shake their heads at the best of our current computer modelling attempts.

Despite the relative infancy of CFD as a tool, it is playing an increasingly important role in every facet of science and engineering. To mention a few applications, it is used to predict the weather, design electronic heatsinks, study blood flow in arteries, design heat exchangers, reduce drag of moving vehicles, make yachts sail faster, design furnaces, predict glacier flows, quieten fans, improve bearings etc. It was used to explain Jupiter's red spot, and played a key role in New Zealand's America's Cup victory. The steam locomotive of course provides an endless supply of fluid-mechanical problems. I wonder what CFD will tell us about the smokebox, for example. (Watch this space!)

I started this article hoping to discover everything about ball valves, but so far have only scratched the surface. The CFD indicates how remarkably complex they are. But it's nice to know that we can carry on using the rules-of-thumb!

(Allan Wallace PhD is a member of SASMEE and AMSRS. He is a partner in an Adelaide consulting firm and specialises in fluid mechanics.)

Roundup of Recent Rallies

1999 Hot Pot Run

by John Oliver

QUESTION: What do live steamers do to have a good time on a June long weekend?

ANSWER: Load up your loco (or in my case your traction engine and loco) in your vehicle, hook up the camper trailer and all your gear plus 2 cans of the soup of your choice and head for Wollongong to the Illawarra Club for their Annual Hot Pot Run.

This year's run had all the right ingredients: good facilities, excellent track, great company and most importantly perfect weather and with in excess of 40 locos — both steam and diesel in attendance (not forgetting two traction engines and one steam truck) a great weekend was had by all.

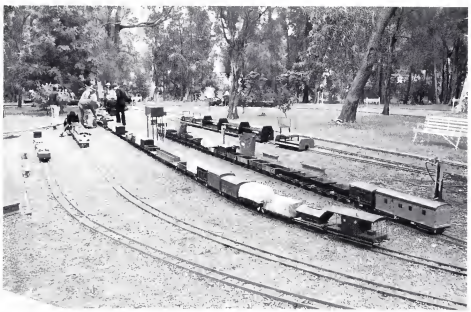
It is a credit to the members of the Lake Illawarra Club to see the magnificent condition of their track site considering the damage caused by the disastrous floods of last year when, I believe, over 5 feet of water swept through the site — this being evident by the high water marks on both the club house and the signal box.

My weekend was spent driving through the grounds behind my traction engine on the Saturday (and I can recommend this to any traction engine owner as you can have quite a good run on both road base and grass). Sunday was spent on the smooth 5" gauge ground level track meandering in and out of the bush on what seems on the first few runs around, to be never ending.

So why did I pack two cans of soup? For the hot pot which is on the boil all weekend. Whenever you're feeling peckish just grab a cup of soup and a large fresh bread roll, or maybe just a cup of coffee — all provided free by the Illawarra Club, have a yarn and your ready to go for another few hours.

Ross Bishop-Wear brings a goods train into the yard behind his Fowler Photo: P Oliver

Now here's something different. It looks like a Clishay and the name would indicate a certain Mr Watkins owns it. Photo: Phyl Oliver



A general view of the yard. The running of scale trains has become a feature of the Hot Pot weekend, as evidenced by the quantity of rolling stock in this view. Photo: Les Mouat

Fourth Birthday Run at Bracken Ridge

by Dave Harper

Photos by Neil Mackenzie

Sunday June 27th was a big day at the McPherson Park track, Bracken Ridge in supposedly sunny Queensland. Unfortunately, the fourth anniversary of the 'turning of the first sod' was marred by the weather, as so many rallies have been this year. It was so wet that I didn't even unpack my camera, but fortunately, Neil Mackenzie was able to supply a few photos to mark the day, and hopefully remind any modellers planning to visit Warner next Easter that Bracken Ridge is just down the road!

As always, Queensland Rail's CEO, Vince O'Rourke, was on hand to officiate. The first photo was taken just after he handed Terry Philip the trophy for the best presented loco for his QR BB18¼.

The next photo shows a remarkable line-up of five A10s. From the front they belong to Jim Stevenson, Dale McClellan, Tom Walker, Peter Beck and Emsley Dieckmann. These neat little locos are deservedly popular as an introduction to loco building with QR prototypes.

The big brass tank in the last photo is the front end of Warren Starr's AD60 Garratt, looking most impressive as it nears completion. That's a lot of loco!

Running during the day was characterised by lack of traction on the wet track, with most trains double headed — there were even two 38 class locos on one train!

Vince O'Rourke, CEO of Queensland Rail (right) has just presented the trophy for the best presented loco to Terry Philip for his 5" gauge BB18¼ class.

The passengers didn't seem to mind the weather, and the local Lions club again reaped the benefit of this excellent combined effort.

I'm not sure what is planned for next Easter, but no doubt there will be plenty of opportunity for any 5" gauge steamers who wish to, to have a run on this popular track.

Five A10s in a row! They are owned by (from front) Jim Stevenson, Dale McClellan, Tom Walker, Peter Beck and Em Dieckmann

The front end of Warren Starr's NSW AD60 class Garratt looks pretty impressive. The rest of the loco is just as good!

Electric Muster at Moorabbin

by John Campbell

Photos by Ken Rofe

With the advent of more electric locos appearing on the Steam Locomotive Society of Victoria track and the club being the home of the Great Eastern Tram (AME issues 74 - 78), it was decided to hold a two day electric run in May 1999 to coincide with our annual Kindred Run. What another great weekend it was!

We had wondered what the weatherman really had in store for us as his forecast kept changing. However, we were lucky and the rain held off until 3pm Sunday.

The weekend was well supported with 18 electrics, 8 steam locos and 4 traction engines which ran on the grass inside our ground level track. Six of the electrics were to my tram outline but some had more powerful C40 or Bosch converted car generators. These motors were the most common in use and most locos had electronic controls which are very smooth and give a better speed control than resistance controllers. I did hear some sad stories of electronic failures but I think that resistance controllers will give quite adequate results for the beginner.

There was a continuous stream of traffic on both tracks, with enough steam operations to live up to our club name. Many of the loco owners used our new electronic weighbridge which can weigh individual axles, and to their surprise, found out how heavy their beasts are!

During both days the electrics were busy giving new owner/drivers a taste of electric driving and numerous questions were asked by potential builders with answers given over endless cups of coffee. The urn was kept busy dispensing tea and coffee and with a BBQ lunch both days plus a scrumptious arvo tea on Saturday, our ladies were kept busy.

The weekend was thoroughly enjoyed

Impressive VR line up — David Newman's B65 and Warwick Brisbane's X52 and C510.

Tea break! Steve Gaal's Maxitrak diesel shunter with a trio of nicely finished trams. This view gives an indication of the diverse finishes which can be applied to these popular tram models

by all who attended, with many people leaving mumbling about 'resistors ohms torque', but smiling. I am sure we were all satisfied with our weekend and our appreciation goes to all involved, especially AME for their support and publicity. Thanks troops!

John Zoutendyk brought his tram Thing *down from Wagga Wagga*

(Above) Keith Hartley's tram no. 2 and (Right) Bill Steward's Iron Horse 4-4-0

Serious discussion over a 2" Fowler, a 3" Burrell and a 3" Cliff & Bunting

Ron Dubber's VR E class tank engine Photo: Keith Hartley

36th Annual Rotary Steam, Horse and Vintage Rally — Echuca

Story and photos by Alan Holding

The June '99 Queen's Birthday long weekend once again saw large crowds of steam and vintage buffs attracted to Echuca in northern Victoria despite the inclement weather.

Echuca could easily lay claim to the title of Australia's Mecca of Steam. Situated on the junction of the "Mighty Murray" and the Campaspe rivers, it boasts a magnificent collection of active steam-driven paddleboats including the world's oldest active wooden-hulled paddleboat, namely the *Adelaide*, and numerous traction engines.

There are some magnificent examples of steam traction and plowing engines, steam trucks, steam portables, steam rollers, and most are in steam and operating throughout the weekend. Broad gauge J515 also came along and offered shuttle rides to points both north and

south of Echuca throughout the weekend.

Additionally, the Campaspe Valley Railway participates in the Rally with its on-site 5 and 7¼ inch dual-gauge track. The track is around 600 metres long and set along the banks of the Campaspe River, within the Rotary Club's property and despite the rain, was kept very busy raisin' revenue over this busy long weekend. CVR has only 21 members but already boasts thirteen locomotives including three LMS "Black Fives" and an 0-8-0 in 7¼" and various other 5 and 7¼" gauge steam locos.

Warren Smith departs the station with a load of passengers behind his 5" gauge Rio Grande 2-6-0

The Rally always attracts visiting loco owners and this year nine blokes from Cobden with one loco (Ron May's 7¼" *Oakstream*). In fact the CVR would never have coped with the crowds without Ron's commitment to running from daylight to dark both days. There were also visitors from Hornsby, Ballarat, BHP Westernport, Lake Hume, Mooroolbark and Box Hill clubs. Phil Vergison's dog Maggie cleaned up the singing dog contest, winning first prize and Phil generously donated the prize of 400 cans of dog food to the RSPCA of Victoria.

CVR was able to show off its new two-aspect colour light signals for the first time. The entire station yard is now interlocked and fully signalled with a new gantry, standing at the entrance to the yard, housing the 'accept' signals. Night running is now a colourful pleasure and safe too. CVR has moving frogs on all of its pointwork and consequently none of the points can be trailed, so night running is enjoyed safe in the knowledge that the road is set appropriately.

Such was the fun had by all that many visitors from the eight clubs represented were urging the CVR to hold an Invitation Run later in the year. Will it happen ... watch the *Coming Events* section to see.

Right: Max Wilson drives his 7¼ LMS Black Five carefully through the points leading into the station with another load of satisfied passengers. As can be seen by the clothing, the weather was not the best, but it did not put anyone off!

Drilling Round Materials

by Peter Johnson

With regard to AME issue 83, page 31 *Drilling Round Materials*, here is another way of doing the "pointer" idea, which is probably a wee bit easier.

I guess the photos explain this method of setting a vee block in place. These drill chucks don't run true, of course, so whichever method is used, you need to fiddle about, turning the cone (or pointer) back and forth to get

a decent average. Having never used the pointer method, I don't know how easy it is but certainly the cone idea is dead simple to use.

The Goldfields Water Scheme

by Bob Moss and "Anon"

Photos and drawings supplied by the authors unless indicated otherwise

The Coolgardie Goldfields, which was the common name for the groups of mines at Kalgoorlie, Coolgardie and the immediate neighbourhood, are located some 363 miles in a direct line from the port of Fremantle in Western Australia. The country east of Fremantle varied from relatively flat coastal plains to granite ranges averaging 1200 feet in height and featuring extensive growths of large hardwood trees suitable for sawn timber production. The country then became a series of broken rolling plains gradually rising towards Coolgardie, changing along the way in to a hot, dry, semi-arid area featuring mainly small to medium size trees and low growth scrub. With an annual rainfall rarely exceeding 7 inches and a high evaporation rate coupled with temperatures often exceeding 100°F there was little in the way of surface water to be found.

Gold is discovered

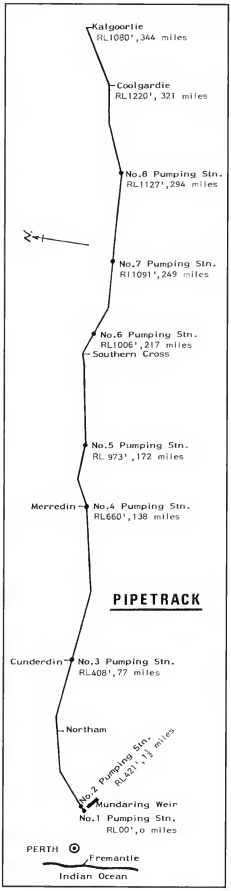
In the year of 1892 the first discovery of gold in payable quantities was made near where the town of Coolgardie stands today and until then, this desolate waterless country had only been visited by nomadic Aboriginal tribes, occasional gold seeking prospectors and explorers. This changed dramatically in the following year when the great gold rush of 1893 set in, resulting in indescribable suffering and loss of life largely due to typhoid. A railway had already been constructed from Fremantle to Southern Cross some 120 miles west of the new gold discoveries, resulting in a journey which had to be made on foot, often pushing a loaded wheelbarrow, on horseback, by stagecoach or any other type of available vehicle. In attempts to provide a potable water supply wells were dug, mainly producing water which was far from potable, resulting in the construction of huge wood fired condensors to provide sufficient water to cater for the increasing numbers of people moving in to the area. The fact that this, the only water available, sold at 2/6 (25c) per gallon provides some idea of what conditions must have been like.

As the gold producing areas expanded and many gold bearing reefs and formations showed signs of becoming permanent, the government did all that was possible to minimise the suffering and loss of life resulting from the conditions under which miners and their families were forced to live. Work started on extending the railway from Southern Cross and the year of 1894 saw the opening of the line to Kalgoorlie, which not only improved living standards but brought about running costs, said to be around 1000 pounds per day, largely due to the huge volume of water being transported.

The Government steps in

The Government decided something had to be done. Mr. G Y O'Connor, Government Engineer in Chief, was instructed to enquire into methods and costs of establishing a scheme for the supply of fresh water from coastal areas where water was available in sufficient quantities to supply the ever expanding goldfields. After months of work and enquiry, Mr O'Connor, in July 1896, reported in favour of a scheme consisting of a reservoir to be built on the Helena River near Mundaring in the Darling Ranges, about 30 miles east of Fremantle, from where water would be pumped to Kalgoorlie. Mr O'Connor left for England in January 1897 with a view to obtaining information on the latest developments in machinery relevant to the proposed scheme.

Mundaring Weir in the Darling Ranges, WA Photo: Dave Merrifield



Mundaring Weir is built

In September of 1898, the Western Australian Parliament approved construction of the scheme.

The weir is located in the Darling Ranges about 5 miles south of the town of Mundaring, a small town located on the main line of railway then running from Perth to Kalgoorlie. In view of the vast amount of material to be transported to the site, a branch line was considered a necessity and was subsequently built.

The site chosen for the weir wall was found to have solid bed rock of granite below the natural ground surface and this became the foundation for the weir wall. Longitudinal channels 6 feet wide and 3 feet deep were formed to provide a key for the concrete wall. This work was completed in January 1900 followed immediately by construction of the wall. Work on this continued night and day until completion in June 1902. An electric lighting plant was installed to provide power for arc lamps, which must have been something of a novelty in those days. On completion, the wall measured 760 feet in length and 100 feet in height at the centre whilst the wall thickness was 15 feet at the top and said to contain 69,000 cubic yards of concrete and rock. The area of water extended 8 miles up stream and was estimated to contain 4,600,000,000 gallons of water. The wall was raised by 32 feet in 1951-52 increasing the capacity to 15,154,000,000gallons.

The pipeline

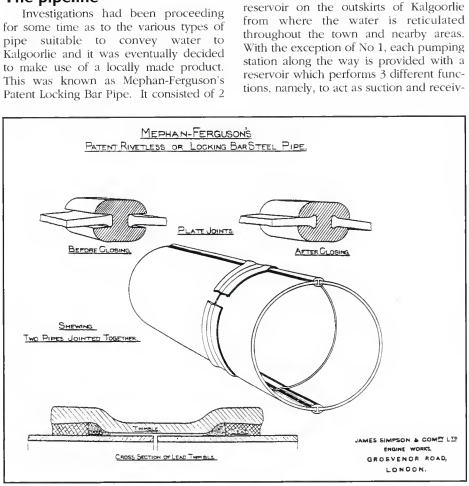
Investigations had been proceeding for some time as to the various types of pipe suitable to convey water to Kalgoorlie and it was eventually decided to make use of a locally made product. This was known as Mephan-Ferguson's Patent Locking Bar Pipe. It consisted of 2 pieces of steel plate rolled in to semi circular form, the edges being upset by special machinery and a locking bar forced on and the joint closed by hydraulic machinery. Each pipe was subjected to a 400 pounds per square inch pressure test then immersed in a bath of Trinidad asphalt until the pipe reached the same temperature as the bath itself. The circumferential joint consisted of a forged steel sleeve with a lead caulked joint. Expansion joints were not necessary. Each pipe measured 30 inches in diameter, 28 feet in length and about 60,000 required. The fact that many of these are still in use says much for the quality of design and manufacture.

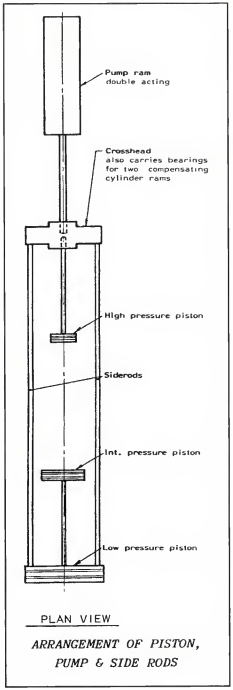
The route of the pipeline was planned to follow the railway to Kalgoorlie as closely as possible in order to facilitate transport of the pipes. The route taken by the railway between Mundaring and Northam was planned to avoid steep gradients rather than to provide convenient transport for steel water pipes which resulted in the use of horse drawn wagons. Beyond Northam the pipes were transported by rail to a point as close as possible to the place of installation, thence by horse drawn wagons to the required site. Stopping a train for any length of time on a busy single line railway to unload pipes was not without problems.

Pumping stations

The pipeline originates at No 1 pumping station located in the river valley downstream from the weir wall and terminates 344 miles to the east at a holding reservoir on the outskirts of Kalgoorlie from where the water is reticulated throughout the town and nearby areas. With the exception of No 1, each pumping station along the way is provided with a reservoir which performs 3 different functions, namely, to act as suction and receiving tanks, to regulate flow in the main and for service purposes. As No 1 pumping station was constructed at the foot of the weir a direct connection would have resulted in a head of 100 feet (now 152 feet) when the weir was full. At No 3 pumping station located at Cunderdin the large reservoir is ¾ mile away and it was feared the pumps may have suffered an undesirable hammer, drawing water from such a distance. The difficulties at both stations were overcome by the provision of stand pipes from which the pumps drew their water.

Eight pumping stations were constructed along the pipeline to accommodate the machinery necessary to carry out the task of pumping fresh water to Kalgoorlie. Some were located at or near towns along the way whilst others were located in lonely outback places in self contained settle-





ARRANGEMENT OF PISTON, PUMP & SIDE RODS

ments, according to the needs of the system and the people who came to live and work there. It should be remembered that there were not many, if any, of those new fangled horseless carriages around in those days, although it has been said that train crews were very helpful.

Pumping stations numbers 1 to 4 each housed 3 boilers and 3 pumping engines whilst numbers 5 to 8 each contained 2 boilers and 2 pumping engines. Internal dimensions of the boiler and engine rooms were:

Stations 1 to 4	Stations 5 to 8
Boiler room 54 feet	41 ft 5 inches
Engine room 73 feet	51 feet

All had a common width of 45 feet and were provided with an 8 foot wide passage separating boiler and engine rooms.

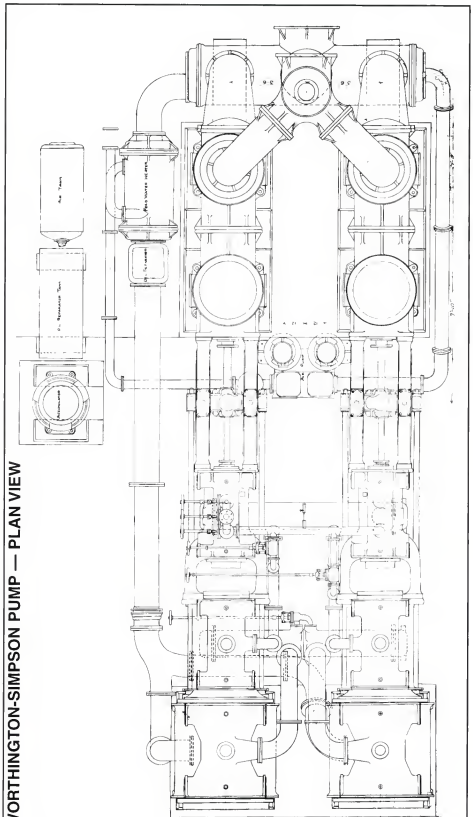
As the proposed scheme had to depend absolutely on mechanical means of forcing water through the pipeline the question of what would be the most advantageous type of engine and boiler had to be investigated most carefully. The entire success of the scheme depended on the working of the pumping machinery and any error in selecting the correct type would lead to disastrous financial results. Briefly, the problem was to pump 5,600,000 gallons of water per 24 hours against an estimated head, including friction, of 2700 feet through a pipe 30 inches in diameter over a distance approximating 330 miles with the speed of water through the pipe being about 2 feet per second.

A total of 20 standard Babcock & Wilcox water tube boilers were provided, each designed to generate sufficient steam to operate one pumping engine. Each was built with a single drum 23 feet 7 inches in length and 4 feet in diameter, 81 water tubes 18 feet long and 4 inches in diameter and a superheater placed between the water tubes and boiler drum. A mud drum was located below the water tube header at the rear of the boiler. Each group of boilers was provided with a Green's Economiser in which boiler feed water was heated by hot gases passing from the boilers to the chimney.

Tenders for the 20 groups of machinery required for the scheme were called world wide in 1899 with all the best known and reputable manufacturers of pumping machinery being invited to tender. It was said that the whole world was in competition as the invitations to tender were not confined to any one country. After months of careful enquiry into the tenders submitted, the Government, acting on advice from their engineering consultants overseas and in Australia, decided to accept the tender submitted by James Simpson & Co. Limited of London. A special clause was inserted in the contract giving them permission to have half the manufacturing done by the Worthington Company.

The accepted tender was by no means the lowest, but the proposals made by the firm were of so complete a nature and the design of the engine offered, the Horizontal High Duty Direct Acting Worthington Engine, was guaranteed to give such highly economical results in working that the Government decided to pay the higher price especially as it was known that the Worthington Company and Messrs James Simpson & Co. Limited had the greatest experience in the world of water works and pipeline machinery. The Government could not, and dared not, risk a failure and they therefore decided to give the work to two firms who held such a magnificent record. Under the contract Messrs James Simpson & Co. Limited agreed to completely erect and have in full working order the whole of the pumping machinery, boilers, accessories etc. within 27 months of signing the contract.

Twenty steam pumping engines were



WORTHINGTON-SIMPSON PUMP — PLAN VIEW

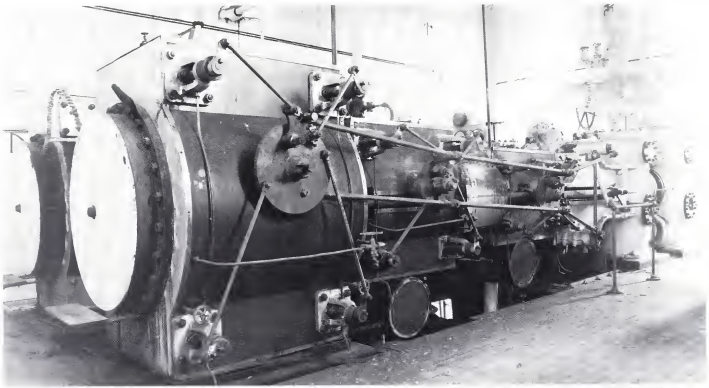
constructed to service the scheme each having:

- Two high pressure cylinders each 16 inches bore.
- Two intermediate cylinders each 25 inches bore.
- Two low pressure cylinders each 46 inches bore.

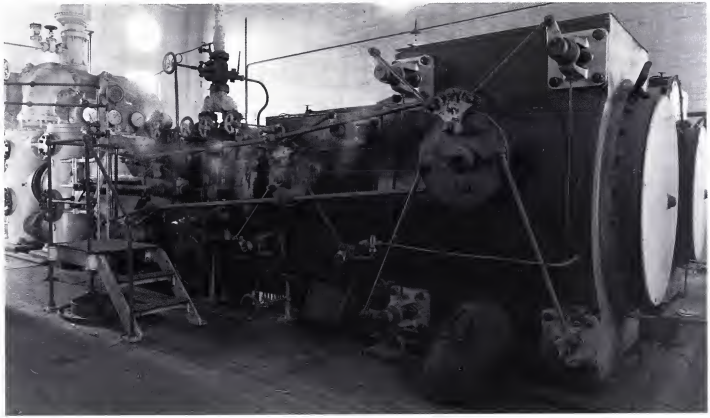
Stations 1 to 4 were each provided with 3 engines, each fitted with 2 double acting water plungers 15 inches in diameter. And stations 5 to 8 were each provided with 2 engines each fitted with 2 double acting water plungers 21 inches in diameter and water valves of increased size because of the increased flow due to lower head pressure.

From the above it will be seen that the water ends of the pumps were the only components of the engines which differed thus reducing greatly the spare parts required to be held.

The pumping station buildings were constructed of brick and provided with corrugated galvanised iron roofs. The pumping engines were mounted on granite bed stones supported on brick piers which in turn were supported on the lower engine room floors laid with concrete and rendered with cement mortar and the upper, or working floors, were laid with jarrah timber. Boiler room floors were of concrete. Whilst the water ends of



Views of both sides of a Worthington-Simpson pump. Note the unusual valve gear, described as a Worthington variation of Corliss valve gear



the engines were bolted to the granite bed stones, the steam ends were free to move on expansion rollers. In all the years these pumps operated there was never any reported movement in any of the 20 groups of machinery.

At 6 of the pumping stations, reservoirs 15 to 20 feet deep were provided adjacent to the pumping machinery to receive the discharge from the water main and to provide storage of water for the pumps to draw from. In order to reduce suction lift and to facilitate pumping, the centre lines of the plunger cylinders were located at a level 8 feet below the water surface of the reservoir. Due to differing circumstances at stations number 1 and 3 special arrangements were required. These have been mentioned previously.

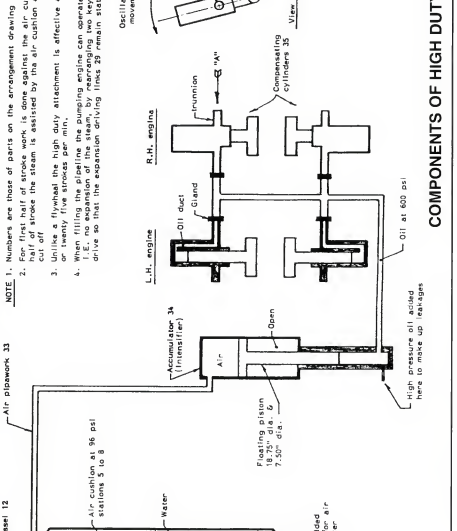
The pumping engines have been described as horizontal, six-cylinder, high duty, triple expansion, surface condensing, of the Worthington duplex direct acting type. The normal stroke of the pump plungers is 36 inches with a piston speed of 150 feet per minute. The pump plungers are externally and centrally packed and directly connected with the steam pistons. The steam cylinders are jacketed throughout, including cylinder covers, and provided with steam at boiler pressure. The steam is re-heated on its passage from the high pressure cylinder to the intermediate pressure cylinder and again prior to entering the low pressure cylinder. The re-heater tubes are placed low on the cylinder thus providing drainage for both cylinders and steam jackets as required.

Steam distribution and exhaust is controlled by a Worthington variation of Corliss valve gear with the cut off being adjustable by hand whilst the engines are running. From the air pump, the condensed steam passes through an exhaust heater placed in the exhaust steam main to the condenser and is delivered to an elevated feed water tank in place of the ordinary hot well. From this tank the water gravitates to a Webster feedwater heater, a device similar to a condenser, with the water to be heated passing over the tubes whilst the exhaust steam passes through to the oil separator where it is further heated by admixture with the jacket condensation and with the exhaust from the boiler feed pump. From the heater the water is pumped by a Worthington feed pump through the economiser back to the boilers.

The pumping engines were all fitted with a device known as a High Duty Attachment, designed to operate on a pumping engine as a flywheel on a reciprocating engine. Four compensation cylinders, two for each engine, are mounted by means of trunnions carried in bearings on the main frame. Each cylinder contains a single acting ram screwed in to a T headed thrust pin which works in bearings carried on the crossheads. Movement of the crossheads creates an oscillating movement of the cylinders causing the rams to move in and out. An oil pressure of 600 pounds per square inch is maintained by a ram operated by an air accumulator and fed into the compensating cylinder ensuring that this is maintained under a constant pressure. During the first half of each stroke of the crosshead, the compensating cylinders exert a retarding pressure. At mid stroke they have no effect on the movement of the crosshead but once beyond this position, they begin to exert pressure in the direction of the crosshead movement, which increases as the expanding steam in the cylinder reduces pressure.

What has been described as one of the major problems was the shipment from England to Australia of 3500 tons of plant, consisting of 5000 items, each of which was needed to perform a certain function at one of the 8 pumping stations to be built mostly in remote areas of Western Australia.

There were 20 groups of machinery each consisting of one pumping engine and one boiler plus large quantities of associated parts and equipment, which for various reasons, had to be delivered to certain sites located over a distance

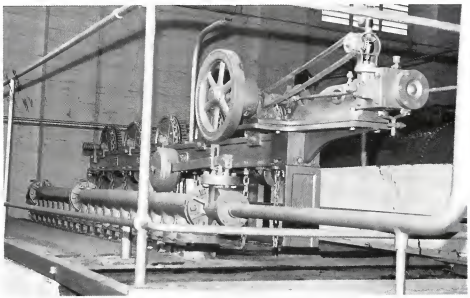


extending across some 300 miles of country. The problem was solved by allocating a certain colour to each pumping station and to each item intended for delivery to the station of the same colour, thus ensuring that deliveries were made to where they were intended. Packing cases were painted on either end with the colour relating to a certain station and no item bearing a different colour was permitted to be placed in a case not bearing the same colour. Deliveries were duly made to the required sites with the loss of but one $1/2$ inch brass valve. Railway, shipping and wharf operators were supplied with coloured group key plans and so were able to pick out at once the various cases and packages belonging to each group and send them to their correct destinations.

Pumping commences

The first pumping took place in April 1902 when the weir and subsidiary works were practically complete. On January 22 1903, Lady Forrest started pumping machinery at an opening ceremony held at Mundaring Weir. Two days later, two functions were performed by Sir John Forrest, a former Premier of Western Australia. During the morning of January 24 1903, Sir John opened a valve to officially open the Goldfields Water Supply at Coolgardie. In the afternoon of the same day he performed a similar ceremony at Mount Charlotte reservoir at Kalgoorlie.

The establishment of a reliable water supply encouraged development of land along the pipeline resulting in an influx of settlers establishing farms and small towns providing shops and other benefits to the residents of these new areas. As the population increased so did water consumption and, as development progressed it became apparent that the water supply would not be able to cope in the future. It was decided to provide more modern pumping stations with sufficient capacity to cater for the needs of the rapidly developing areas.



Green's Economiser as fitted to the Babcock & Wilcox "WIF" boilers. Photo: D Merrifield

Steam pumping stations numbers 1 and 2 were the first to be replaced in 1954 by an electrically powered station with enough output to replace both. In 1956 No 3 station at Cunderdin closed followed in 1960 by No 4 at Merredin and No 5 at Yerbillon. An electrically powered station with sufficient capacity to replace steam stations numbers 6 and 7 opened at Ghooli early in 1970, resulting in their closure. The end came later in 1970 when No 8 steam pumping station at dedari closed. The replacement was diesel driven until electricity became available some years later.

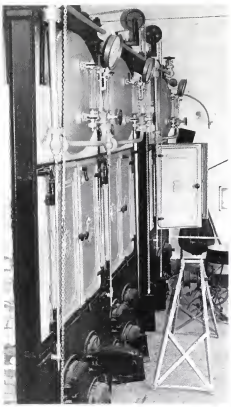
B & W "WIF" boiler front burner showing sinusoidal headers and drum. Photo: D Merrifield

The pumping stations now

So ended an era of 66 years when steam pumping engines provided fresh water to the Goldfields.

Today some of the old pumping station buildings remain whilst some have disappeared:

- **No 1 Mundaring** — houses a museum named after C Y O'Connor. Many relics are on display including 3 Babcock & Wilcox boilers and an original pumping engine.
- **No 2 Mundaring** — demolished.
- **No 3 Cunderdin** — is now a museum containing a pumping engine and historic items relating to the area.
- **No 4 Merredin** — now used by local industries
- **No 5 Yerbillon** — still standing, unused.
- **No 6 Chooli** — contains 1 complete pumping engine, 1 partly dismantled and 2 Babcock & Wilcox boilers.
- **No 7 Gilgai** — demolished.



Lineup of B & W "WIF" boiler burner fronts. Photo: Dave Merrifield

- **No 8 Dedari** — virtually complete.

The planning and construction of the Goldfields Water Scheme resulted in much criticism being levelled at Mr O'Connor by politicians and the press to the extent that he took his own life.

The inquest jury found:

"Charles Yelverton O'Connor met his death by his own hand through a bullet wound from a revolver at Robb's Jetty, Fremantle on March 10th 1902 while in a state of mental derangement caused by worry and overwork."

Indexing in the Lathe

by Brian Smith

You have a job in the lathe and would like to index the lathe spindle, but don't have anything to give you the indexing steps you require. Here is a simple method which may solve the problem. In simple terms it involves wrapping a graduated strip of material around the chuck or face plate and lining up the graduations with a pointer.

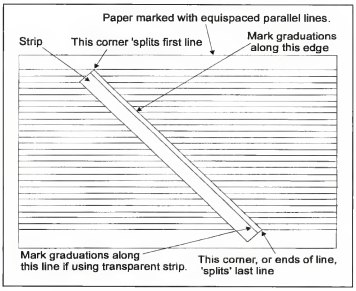
1. Cut a strip of paper long enough to wrap around the circumference of the chuck back plate, face or catch plate. Ensure one edge is straight. Transparent paper is better in which case draw a light straight line about 3mm from one edge. (see diagram)
2. Temporarily tape the paper in place so that you can cut the ends to just butt them together.
3. Remove the strip.
4. Divide the strip into the increments you require. This can be done several ways:

   (a) Measure the length of the strip and divide by the number of increments plus 1. You may be lucky and the resultant measurement will equal a suitable graduation on your rule. If not:

   (b) On a sheet of paper mark out some equi-spaced parallel lines equal to the number of increments plus 1. Ensure that the measurement from first to last lines is less than the length of your strip — say about ¾ of the strip length. The spacing does not matter and can be whatever is convenient.

   (c) Lay your strip over the sheet so that one corner of each end of the straight edge (or the ends of your line) 'splits' the first and last lines you have marked. (see diagram). Lightly tape the strip in place.

   (d) Where the strip edge (or line) 'cuts' each line on the sheet make a light mark either by sharp pencil, scriber point or pin. Remove the strip from the sheet.
5. Draw a thin line through each 'mark' at 90° to the strip edge or line.
6. Tape the strip in place on chuck, face or catch plate so that the two ends butt together. Ensure the tape does not obscure the graduation marks.
7. Use is a matter of setting up a suitable indicator (scriber point) to pick up the 'graduations' on the strip so that the chuck, face or catch plate can be carefully indexed.



Tips to make it easier

1. Instead of lining a sheet of paper use something pre-printed with lines - writing pad, graph paper.
2. Use a magnifier to mark graduations and when indexing.
3. Make the 'graduations' on the strip as thin as you can still see OK.
4. Mark and number every 5th or 10th 'graduation' on the strip. Helps find your 'place'.
5. Set up the indexing pointer to view it in your normal position at the lathe without crouching to line up the graduations. This helps ensure consistency of alignment.
6. Set the pointer as close as you can to the strip without actually touching it.
7. Rigidly mount the pointer.

Accuracy

This depends on how carefully you have marked out the sheet and strip, how carefully you line up the strip markings and how well you concentrate when doing so. This method will not 'lock' the chuck etc as an indexing pin would. It is OK for graduating dials but I would not consider any heavier metal cutting operations without clamping (locking) the lathe spindle between 'indexings'.

Another Pipe Bender

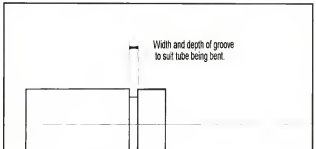
by Bruce Allen

At the moment these seem to be proliferating like coat hangers in a dark wardrobe. One problem that I see with the latest crop of published ones is that the radius of the bend is set. If you want it a bit bigger or a bit smaller, or you need to use a different sized tube it is back to the workshop to rebuild the parts or make another one.

As they say in the song, "Hang on, help is on the way." For the smaller sizes I use a broom handle. This is placed in the lathe and a parting tool is used to make a groove exactly the width of the tube and of sufficient depth to give the required radius. The depth of the groove should also be, in practice, at least equal to the diameter of the tube.

When you are using the bender make sure that the tube is well annealed by heating it to dull red in the area of the bend. This bender can produce some really tight bends but even annealed tube may need at least two annealings to produce a satisfactory result.

I have been using benders like this for years. If you lose one there is no problem. What is a minute or two between friends to make a new one?



Club Roundup

compiled by Neil Graham

Auckland NZ

Auckland Soc. of Model Engineers

ASME is forty years old this year and a special celebration is being organised, with the Royal Hall at the Greenlane Expo Centre booked for an exhibition which will be the focal point of the celebrations. In the meantime, work in the steaming bays and gardens has kept everyone busy.

There has been a change in direction for the type of club locomotive to be constructed. It now looks like an engine along the lines of a NZR Dsc is being favoured.

The 1999 Easter weekend attracted people from afar as New Plymouth. There were plenty of exhibits and the Concourse de Elegance was won by Ted Carter with a 7¼" gauge Rogers Q class locomotive. The dinner was attended by 44 well satisfied people.

From its genesis in a casual conversation, Alan Roberts has constructed a pulse jet engine. This one metre long model is well advanced and the experts have assured all that when Alan fires it up in Pukekohe, people will think the Waikato Wars have started again, such will be the noise!

Scale Marine Modellers

The April club night was well attended with 11 boats (items) tabled and one of the more different was Dick Hoppers model of the Bean Rock Lighthouse, which is an octagon lighthouse up on piles. This 1/24 scale model of the lighthouse which guards the entrance to Auckland Harbour is fitted with solar panels to power the still to be fitted electronic gizmo which will control the light. Its permanent home is to be the lake at Monterey Park.

The new motorway by-pass to Pakuranga seems to have reduced the visitors to the basin area for the Easter Exhibition. However, those that came (especially the kids driving the club's boats) enjoyed themselves. There were 33 models on display.

April 18 saw a different type of course set. Everyone had just five minutes. Bob Kempster won both the steering and sailing on this day.

The sailing committee has had the worst sailing year in memory with only two rounds of sailing completed. Most of the competitions were won by the inclement weather or totally becalmed. The towing comps were mostly won by the barge! The barge has since been modified by Bob Melse and is now more "towing friendly". Mercantile steering was again closely contested with twenty members taking part.

The annual competitions awarded Bob Kempster the Skipper of the Year, with most improved modeller being Bob Walters.

There is now a new agreement between the ASME and SMM on the use of facilities. This is in the form of a lease to SMM rather than the previous "affiliation" type arrangement.

Model X 1999 was a hugely successful display, with some 38 boats on display. Large crowds on the Sunday and a mention on TV1 news again saw large numbers on the Monday.

ASME Inc. and SMM
Location: *Shared facilities, Peterson Road Reserve, off Waipuna Road, Panmure*
Public Running: *Every Sunday*

Bulla VIC

On site at Bulla, the flashings have been completed on the workshop, to the council's satisfaction. The large coal bin has been completed and the previous poor rolling problem with the large traverser has been remedied at great expense. A four cent circlip was put in its correct position. New member Michael Hibbert jumped in straight away with his own concrete drill to run the dynabolt holes in to mount the steam-up bay posts.

April 24 was a big day at the club with some inspired tree planting in the morning, BBQ lunch, then marking out in the steam up bays. Locomotives were then serviced ready for their run the next day.

The two club locomotives are undergoing major repairs and modification. The firebox refractory linings have broken up and need replacement, which is a periodic job.

The City of Hume has given the club a further extension of two years for use of the temporary station.

The committee has approved the use of 5" gauge locomotives on public running days.

Tullamarine Live Steam Society
Location: *15 Green Street, Bulla*
Public Running: *1st and 3rd Sunday*

Burnaby BC, Canada

With less than 12 months to go, preparations for the IBLS 2000 — Meet of the Millenium continue apace. A small trestle and block retaining wall are in the works. John Sayer has come up with an ingenious toggle mechanism for the new track points. It is also intended to power up some of the facing points on the mainline. Canada Customs information is being prepared as well as accommodation and "how to get to" site maps.

A Web site is now set up at:

www.bcsme.org and also www.halcyon.com/dfm/IBLS2000 for IBLS 2000 info.

British Columbia Soc. of Model Engineers
Location: *Rainbow Creek Station, 120 Nth Willingdon Ave, Burnaby*
Public Running: *Saturday, Sunday & public holidays, Easter to mid-October.*

Canberra ACT

The junction turnout has been overhauled and fitted with an electric drive. Work is in hand to overhaul the remaining turnouts and fit electric drive units. A start has been made on the levelling and top dressing between the tracks along the main straight, and will be an ongoing project as resources become available.

Canberra Society of Model & Experimental Engineers
Location: *Geijera Place, Kingston*
Public Running: *Last Sunday*

Cape Town RSA

Things are progressing rapidly on site. A single loop has been laid and work is now in progress with the turntable and steaming/unloading bays and the platform. A load of road tailing has been delivered and this has been put to good use to stabilise the car parking area. One member has a number of tree seedlings developing.

Heinryh Binedell has developed and demonstrated an air/hydraulic points control system, which has been accepted by the committee.

The club has had a magnificent response to the railbar appeal for track extensions. A very generous gift of 50 lengths of galvanised bar has been gratiously received, and, it was transported from Port Elizabeth for free!

Western Province Live Steamers
Location: *5th Avenue Sports Complex, Parow*
Public Running: *???*

Eltham VIC

While the Corroboree '99 started of slowly, it finished with some very late night running on the second day. Saturday was fairly quiet, the Sunday was much busier. Visitors came from as far as Cobden.

On the works front, the surface of the No.2 departure platform has been ground to remove what was seen as a tripping hazard. Stage 3 of the new fencing around Diamond Valley station has been complet-

ed and an information sign has been erected at the entrance of the picnic site. Work has commenced on the laying of track and checkrails on the Coleman bridge and Sanctuary trestle. Tree planting on the "Avenue of Honour" progresses well.

The latest rolling stock report saw 11 locos and electric/railcars in service and the two club steamers under repair. Steady progress is being made on the new loco 8172. Only one major panel to be fitted and some body detailing to complete. Testing should commence soon.

In February the Taft set were transferred to Box Hill for relief duties. DERM55 also made the journey. A good day was had by all and the two trains were safely transferred back to Eltham at dusk.

In March, the Puffing Billy Railway people invaded the DVR and bad weather did not deter anyone — the trains were run all day. With 400 odd people present, friendliness and camaraderie resulted in a great day had by all.

Diamond Valley Railway Inc.
Location: *Eltham Lower Park, Main Road, Eltham*
Public Running: *Every Sunday and public holiday.*

Galston NSW

The good news is that by the time this is read, those generous members who helped the GVR to purchase the property should have all been re-paid their dues, well ahead of the projected expiry date. This excellent outcome is due to the exceptional effort of members over the last five years to make every event a success.

There have been special board meetings to detail the upgrading of the operating code — the new code has been broadened to cover additional topics.

Work on the model road vehicle track has largely been completed with the surface being hot-mix bitumen sealed. Also contractors have completed sealing the lower entry road which leads to the concrete road approaching the steaming bays.

D-Day (diesel day) was 5 June last and was a non-steam day. There were 13 diesel outline locos in attendance. A highlight was the representation of three different types of NSWR railcars. Interesting to note, that while there were less people than last year, there were more engines, only two of which were non NSWR types. Reg Watters provided a rake of scale wagons to run for the day.

What has your club been up to?

We all like to keep in touch!
Send a brief note to tell us!

Or post a copy of your **newsletter** — but make sure you use a highlighter pen to show the item you would like us to publicize. Remember to concentrate on news that appeals to AME's wide range of readers.

From the boating pond, reports that the new wharf at Fagan Park is fully operational and members are very proud of their excellent facility. At the opening of the new wharf, there were around 35 vessels from visiting clubs. As well as regular days, the boating group sail on Australia Day, Autumn Fair and the Spring Festival.

Hornsby Model Engineers Co-op Ltd
Location: *29 Mid Dural Road, Galston*
Public Running: *2nd Sunday*

Gosford NSW

Completed project has been the guest party station. This covered area looks good. The running days have three to four trains in service and the days run without hiccup. The ticket and station staff have a hard job sometimes as they have to turn away people, who sometimes refuse to understand that they must wear suitable footwear to ride the trains.

The Lions Club run day proved to be a great day for all as they had a good turnover in the canteen and the club members freed from these duties took up more railway-like tasks.

Central Coast Steam Model Co-op Ltd
Location: *Lot 10 Showground Rd, Narara*
Public Running: *1st Saturday*

Invercargill NZ

The old train shed roof has been painted as has the clubhouse after some repairs. All that remains is touching up around the windows and bargeboards. Club loco *Periwinkle* has had the running gear stripped down for overhaul and the portable track is being refurbished.

The May running day was attended by some very hardy people who had a brief run on the track and one member even sailed a boat on the pond.

Southland Soc. of Model Engineers Inc.
Location: *Surrey Park, Invercargill*
Public Running: *None*

Jerilderie NSW

The members of Jerilderie Steam Rail advise that they now have a regular running day. This is the 2nd Sunday of each month plus the fifth Sunday when this occurs

Jerilderie Steam Rail & Heritage Club
Location*: natural reserve, town centre*
Public running*: as above*

Mangere NZ

The MLS has gained several new members over the last few months. Several own, or are building locomotives and most of them have become very active with helping out on the Saturday work parties and on the Sunday running days. One new member, Steve Day hails from South Africa and has brought his stable of locomotives with him (as well as his family). One of them, a 5"gauge SR&RL No. 24 has already entered service with the club.

New big power seen at the track on the Queen's Birthday weekend (which was very busy passenger wise) was Chris Art's NZR Ka class 4-8-4 in 7¼" gauge, which had its first run. As expected with Chris's work, it ran perfectly.

Manukau Live Steamers Inc.
Location: *Mangere Central Park, Robertson Road, Mangere*
Public Running: *Every Sunday*

Maryborough QLD

The club's "Sunday in the Park" activities continue to be well patronised. The club has purchased bogie wheels to allow the completion of a dozen sets of passenger bogies and this will allow replacement of some of the bogie sets now in service.

MELSA members were fortunate enough to be invited on a pre-service run of the new QR tilt trains. Many members availed themselves and a favourable and lasting impression of a world class train. *(These Maryborough built trains have since set an Australian speed record of 210 kph and are the worlds fastest regularly run narrow gauge trains ... Ed.)*

MELSA Maryborough
Location: *Queens Park, Maryborough*
Public Running*: Last Sunday*

Millswood SA

The re-building of the club 7¼" passenger riding truck continues with the major re-furbishment enabling the wagons to be able to travel in both directions. This will also help even out the flange wear on the bogies, which was a problem with unidirection running.

South Australian Society of Model & Experimental Engineers
Location: *off Millswood Crescent, Millswood*
Public Running: *1st Sunday and 3rd Saturday*

Moorabbin VIC

Many SLSV members have taken an interest in the proposed Gauge 1 railway — the aim to have a dog bone layout of some 15 metres length with entry and exit to and from the mainline. A 45mm gauge track for live steam and those with on board electrics, Manual and RC are the favoured control methods.

Work continues with the retaining wall on the ground level railway passing loop partly demolished and re-installed to widen the track bed. The char bunker apron has been extended, to prevent the delivery truck damaging the bunker itself. Improvements to the ground level rolling stock continues with the placement of flexible covers over the couplings. The surface grinder overhaul continues and the ground level track signal restoration project work has commenced. All old cable and equipment has been removed and a new KISS (keep it simple, stupid!) designed system is being installed, primarily for the safety of the run-on sections. To date some 7500 metres of cable has been run to control the signal functions.

The need for an additional 18 point levers has seen three members go into batch production of components after being supplied with materials for the job.

The Silvertops days over the last few months have seen between 18 and 28 members attend with up to nine locos at times. May 13 saw a special run for 65 children from Langwarrin. Six locos provided the power for the run.

An electric loco weekend was had in late May, with eighteen electric locos (and some steamers) in attendance. Six of the locos were of the very popular Tram design of John Campbell! *(See report on page 36)*

Public days continue to be well patronised and one typical day saw 14 locos on shed for duties. Included in them were Ron Baneth's Tram and Warwick Brisbane's C510. 25 members attended the Wandong Live Steamers invitation run in May!

The timetable run was a success. Each run took about 30 minutes which included four departures, four stops, two runarounds and one major shunt. Eight brave souls participated. The eventual winners were Colin Stanton and Simon Pittard (who did the tender-first legs). A special mention to Peter Gray who turned the reverser screw on his VR X class loco an estimated 5000 turns during his run!

Steam Locomotive Society of Victoria
Location: *Rowans Road, Moorabbin*
Public Running: *1st Sunday ex. January*

Nelson NZ

A new set of flood gates for the pond have been constructed and galvanised and the new frame for the pond control gate is now in place. The club Dsa had been running roughly for some time, but a problem with the choke was diagnosed and has since been remedied. *Natty Lark* has had a coat of paint and some maintenance and will be ready when the pond is filled. Lastly, the club has been fortunate in receiving a substantial grant from the Lottery Commission which will be put to good use.

Nelson Society of Modellers Inc.
Location: *Adjacent Tahuanui Beach, Walkare St, Tahuanui*
Public Running: *Every Sunday afternoon*

New Plymouth NZ

The club is in its 48th year and ideas are being canvassed amongst the members to celebrate the 50th year.

The club has recognised the need for a code of practice and this will be drafted shortly. It is proposed that a video library be set up in the clubhouse for live steam and railway related and relevant subjects.

On the work front, missing battens have been replaced on the overbridge. The repaired bogies have been restored to the passenger trolley and ground maintenance tasks are continuing.

May running day saw Jan Jager's 4-6-6-4 kept quite busy hauling a steady stream of passengers. June run day had two locos on the track, the Challenger and Martin Smyth's Dsa diesel kept the passengers moving.

New Plymouth Society of Model Engineers
Location: *Cnr Liardet and Gilbert Sts, New Plymouth*
Public Running: *Every Sunday*

Petone NZ

Inclement weather has affected the running days. The Speedy has been returned to the clubhouse after a lot of work done to it by Peter Gibbs. He has also built a wheeled stand for it. There are some finishing touches to be completed.

Hutt Valley Model Engineering Soc. Inc.
Location: *Marine Parade, Petone*
Public Running: *Every Sunday afternoon*

Perth WA

The club has introduced new safety jackets to be worn by members so that they can be readily identified by the public. The club has been approached to host the Kosovar refugees (who are in Perth) to the running day. This has been met with enthusiasm by the members.

Castledare Miniature Railways of WA Inc.
Location: *Castledare Place, Wilson*
Public Running: *1st Sunday*

Whangerei NZ

Members have been busy building their new track at Heritage Park. They have got the basic track down and are waiting for OSH certification before they start running.

There are two circuits of track around a knoll. There is an extra loop track in the station area. A yard and steaming bay access comes off the loop and all this is well established. The existing circuits are of about 172m and 168m.

(Courtesy of "Blastpipe", HVMES newsletter ... Ed.)

Whangerei Model Engineering Club
Location: *Heritage Park, Highway 14, Maunu.*
Public Running: *None*

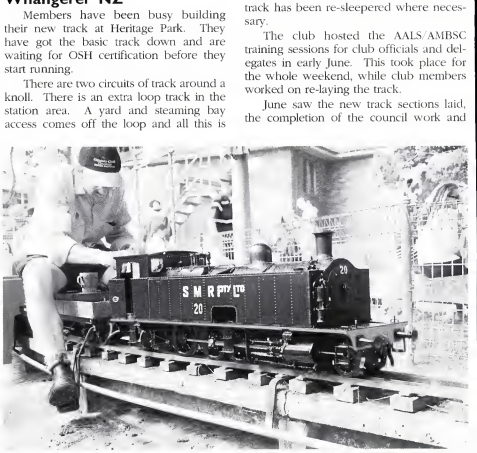
West Ryde NSW

Major civil engineering works at the southern end of the park have been completed and operations are now back to normal. However, to keep interest and faith with the public, in the intervening months the trains operated from point to point using push-pull motive power. There was a loco at each end and the passengers sat forward for the 1st part of the journey, then they disembarked and re-embarked to face forward for the 2nd half of the journey. One train operated the elevated and one operated on the ground level, using both the inner and outer roads. Using short trains to start with in February, as the crews got used to push-pull working these went from three to six cars over three months. Trains ran in this manner in February, March, April and May.

While council works were in progress, Bill Richards and Peter Shiels constructed new track panels to replace the old angle iron sleepered outer main. Also four panels were made and fitted with bridge check rails. These were a masterpiece of track construction and all the removed track has been re-sleepered where necessary.

The club hosted the AALS/AMBSC training sessions for club officials and delegates in early June. This took place for the whole weekend, while club members worked on re-laying the track.

June saw the new track sections laid, the completion of the council work and



Bernie Courtenay's SMR 10 class was a regular hauler during the 'push-pull' era at West Ryde. Brian Carter's Perseverance, *another regular, was on the other end of this train. Note the construction of the elevated track and the anti-tip rail.* Photo: Andrew Allison

the re-laying of the missing sections of the ground and elevated railways. Come running day and 3811 double headed with oily 5902 on one train and John Hurst's Mountain ran the 2nd train on the outer. These two trains ran reliably without incident all afternoon.

Track settling problems on the inner caused some concerns and thus the climb up the hill was very tough. The bottom curve was speed restricted and trains had to bite into the ruling grade with no momentum. This had Ray Lee's 3803 on its hands and knees, but for those who were within earshot, the stack talk was music to their ears. Ray had an unfortunate "re-arrangement" of tender springing while testing out the new check rails. The V class worked the second train on the inner. Things settled down in the cab when the driver realised more coal and power was needed for continuous running (compared to the push-pull workings of the past three months). The new track and its built in super-elevation rode very well, and subsequently the section speeds were gently lifted.

Sydney Live Steam Locomotive Society
Location: *Anthony Road, West Ryde*
Public Running: *3rd Saturday*

Wollongong NSW

The board is looking into options for the Canteen/Clubhouse. The white ants are having a feast in the rafters and will need attention in the near future.

The club has actually had three consecutive running days without a washout!

April went close to stopping, with motive power at a premium after a failure and not many backups available. It was up to the two Hamilton family steamers to carry the flag into the afternoon.

On site, the club's new rainwater tank has been commissioned and is full to the brim! The water has been reticulated to the key watering stops at stations, yards and loco. New guttering has been applied to the south side of No.1 platform station roof. This is now piped to the rainwater tank. Galvanised chain wire around the picnic areas has been installed while track maintenance continues. As a result of last year's flood, the yard has been lifted, re-sleepered, re-ballasted and the track re-laid and is now back in business. The "main" will be attacked shortly.

Illawarra Live Steamers Co-oP Ltd
Location: *Stuart Park, Virginia Street, North Wollongong*
Public Running: *4th Sunday*

Farewell

We say goodbye and thankyou to these model engineers who have passed on:

Keith Bain (Box Hill MSLS)
Alan Bott (Hamilton ME)
Owen Handley (Kapiti MR & Assoc)
Bill Hayman (Lake Hume ME)
Ralph Skewes (SASMEE)
Dick Tucker (Western Province LS)
and also to well known railway author
A E (Dusty) Durrant (South Africa)

and extend our condolences and best wishes to the family and friends they leave behind.

Coming Events

11 to 12 September
AALS Spring Interclub run — St Mary's NSW
The Sydney Society of Model Engineers cordially invite you to attend the Spring interclub run at our track, 869 Luddenham Road, St Mary's. AALS meeting 3pm on 11th. Full camping facilities and refreshments. Running both days and night run Saturday. To help us cater properly for our visitors, could you advise if attending. All welcome, with or without models.

18 September
All Comers' Day — Box Hill, Vic
Box Hill Miniature Steam Railway Soc. Invite you all to this special day. 5" and 7¼" track, BBQ lunch and afternoon tea provided. Don't forget to bring your boiler certificate. Contact Tony Richardson (03) 9795 3695

25 to 26 September
Canberra Invitation Run and Floriade — Canberra ACT
Trains and tulips in the spring is here again. Track is dual gauge 5" and 7¼", elevated 2½" and 3½". Elevated steaming bays, water, 12V dc. Swing-nose frog turnouts accept wheels almost any standard. Min rad. curve 13.7m (45ft). Char, briquettes, steam oil and petrol (2 and 4-stroke) provided. Saturday members and guests Sun. reg. running day, visitors welcome. Boiler certs req. BBQ facilities. Spit roast Sat night $14. Sleeper car bedding avail $15 head. Ph/fax John Nicolson (02) 6247 7182

2 to 3 October
Central Coast Birthday Run — Gosford NSW
Due to the inclement weather in recent years, the club has voted to move its annual Birthday Run from September to October. Saturday 2nd will be public running (visitors not obliged) followed by night running and play day on Sunday. Contact (02) 4388 2416 if attending, especially night run, so catering can be arranged for the evening.

8 to 10 October
Hornsby MES Birthday Run — Galston NSW

9 to 10 October
Railway & Traction Engine weekend — Berry NSW
(Note the amended date)
Our 7¼" Railway & Traction Engine weekend is on again. 2km of 7¼" gauge track and meandering pathways for traction engines, all in a beautiful rural setting, just 45 mins south of Wollongong. On site accomodation available. A great weekend for model engineers and families/friends. Not open to the public. Enquiries: David Price (02) 4464 2196 or Trevor Lawrence (02) 4447 8417

22 to 25 October
Keirunga Park RR open weekend — Havelock North NZ

16 to 17 October
Spring Festival Invitation Run — Cobden Vic
A warm welcome is extended to all model engineers and other interested parties to join us in the annual Spring Festival, which is centred around Railway Park and our miniature railway. Lots of family activities. The Cobden Golf Club Restaurant has been booked for Saturday evening. Hotel, backpacker and motel/caravan park accommodation. We can make reservations for you. Contact Jim Walsh (03) 5595 1251 or John Wiggins (03) 5595 1430.

22 to 25 October
New Plymouth SME open weekend — New Plymouth NZ

22 to 25 October
Hamilton ME Fun Weekend — Hamilton NZ

23 to 24 October
11th National Miniature Traction Engine Rally — Inverell NSW
This year the rally moves north again. See next page for details. Organiser Gordon Blake (02) 6722 4272

30 to 31 October
1999 Blowfly Rally — Orange NSW
5" gauge track, 12V & 240V power, compressed air and char available. Some loco storage and limited camping facilities.

30 to 31 October
40th Anniversary Exhibition — Auckland NZ
Auckland Soc of Model Engineers are hosting this milestone event in the Royal pavilion at the Expo Centre, Greenlane

5 to 7 November
Railex 1999 — Evandale Tas
Model Transport and Model Engineering Exhibition
Fri 11 am - 7pm, Sat 9am - 6pm, Sun 9am -3pm. 3½", 5" and 7¼" gauge track. Displays include Steam Gallopers (Carousel), model railways, stationary engines, model aircraft (static), cars, boats, vintage cars, notor cycles. Swap and trade tables, Railway Preservation Society display, hot food, drinks and musical entertainment. Go past Launceston airport and follow the signs
Webpage at www.vision.net.au/~elrss. Contact Graham Reardon (03) 6344 6636(H) or (03) 6343 1000(W)

6 to 7 November
Wagga Wagga Invitation Run — Wagga Wagga NSW

6 to 11 January, 2000

Model Engineers Convention — Blenheim NZ

Marlborough Associated Modellers are hosting this 2-yearly event. $2\frac{1}{2}$", $3\frac{1}{2}$" and 5" elevated and 5' and $7\frac{1}{4}$" ground level tracks. Boat pond with harbour complex and tethered car facilities. Registrations close on October 31. For further details contact the Convenor, Convention 2000, 8 Arthur Baker Place, Blenheim 7301, NZ

21 to 24 April

AALS 44th Convention — Warner Qld

QSMEE are hosting the year 2000 Convention. Preliminary information should be reaching clubs about now, and registration forms will be ready in October. Start planning now for the last convention of the millennium! For further info. contact Convention Secretary, Bob Campbell, PO Box 322, Everton Park 4053. Ph. (07) 3263 7462 (or Club Sec. Hugh Elsol (07) 3849 5573.

20 to 21 May

LHME Invitation Run — Wodonga Vic

Lake Hume Model Engineers invite you to Wodonga Creek Miniature Railway to join in their second annual invitation run. Further details later.

12 to 14 August

IBLS Meet of the Millennium — Burnaby, B.C. Canada

See below for more details. Contact Barry Glover 31 Spinks Road, Corrimal NSW 2518, Fax (02) 4283 2331

7 to 8 October

4th Old wares Expo — Warragul Vic

The West Gippsland Vehicle Restorers Club Inc are holding their 4th Old wares Expo at the Warragul Showgrounds. There will be displays of collectables, memorabilia, steam machines, household wares, historical photography, vintage vehicles, yesteryear fashion parade and much more. Contact Greig Wilson (03) 5623 1493

IBLS 2000 Tour — Proposed Itinery

We are now three quarters of the way through 1999! The new year will be on us before we know it and that means time is running out if you are thinking you would like to go on this great trip to North America to take in the IBLS Meet of the Millenium in Burnaby BC and visit other well known live steam sights. This is the proposed itinerary. ***Don't miss out — get your name in now!***

Date	Event
August 2000	
10 (Thur)	**Depart Sydney**
10 (Thur)	**Arrive Vancouver (possibly via San Francisco)**
	Accommodation required for nights of 10, 11, 12, 13, 14, and 15 Aug
11 (Fri)	**Full day Royal Hudson trip (Transfer by own mini bus)**
12 (Sat)	**British Columbia Society of Model Engineers - IBLS Meet of the Millenium**
13 (Sun)	**" " " " " " "**
14 (Mon)	**" " " " " " "**
15 (Tue)	**Sight seeing, etc. around Vancouver**
16 (Wed)	**To Vancouver Island, V I Model Engineers (overnight VI)**
17 (Thur)	**Sightseeing VI (Butchart Gardens, etc.) Return to Vancouver pm and overnight in Vancouver**
18 (Fri)	**To Seattle**
19 (Sat)	**Seattle sights, possibly including Boeing factory**
20 (Sun)	**3 nights accommodation (is Boeing open at weekends?)**
21 (Mon)	**To Portland, accommodation 2 nights**
22 (Tues)	**Portland Zoo and other sights**
23 (Wed)	**Tom Miller's track (Big Boy), Accommodation locally?**
24 (Thur)	**To Klamath Falls, 3 nights accommodation**
25 (Fri)	**Train Mountain**
26 (Sat)	**" "**
27 (Sun)	**To San Francisco, 4 nights accommodation**
28 (Mon)	**San Francisco sights / free time (Cable cars)**
29 (Tues)	**" " " Alcatraz, BART, etc**
30 (Wed)	**Golden Gate Live Steamers**
31 (Thur)	**Depart San Francisco for Sydney**

The above information is based on drive-yourself groups of 6 per vehicle. This allows more flexibility than a coach, but does require driving on the other side of the road. If you wish to volunteer as a **driver**, please indicate with your reply. Also include a self-addressed DL size envelope for further information. Contact:

Barry Glover
31 Spinks Road, Corrimal, NSW 2518
Ph (02) 4284 0294, Fax (02) 4283 2331

11th Miniature Traction Engine Rally — Inverell, NSW

Having hosted two previous rallies at Inverell in 1995 and 1996, members of the Pioneer Village are looking forward to hosting the 11th gathering of traction engine enthusiasts.

It has been said by many people that the venue is near perfect for such an event as it is set amongst buildings dating from 1840 to 1930, complete with artifacts for the period. There is a large machinery display which includes an 1877 Waterous Portable Engine. Visitors will miss the Robey Traction Engine — it's in Tamworth being restored to running condition.

Visitors, other than rally participants, will be charged the normal entry fee to the village, $4.00 Adults, $2.00 Children. This allows visitors to view the models as well as being able to inspect our wonderful museum. Refreshments will be available both days. As usual we will have an evening meal for rally members and other interested persons, the fee for that will be $12.00 per head, and catering will be undertaken by the Village Ladies Auxiliary.

E & J Winter will have a trade display in Oakwood Hall. They always have a good supply of books, plans and castings of interest to model engineers. Also John Buckley of Tamworth will have a display of tools. John is an agent for LPR Toolmakers but will source any tools, etc. from his many contacts.

A Grand Parade will be held on both days as well as some slow races and slalem events, that is if we can con John Oliver to carry on from the fine job he did with the Canberra Rally last year.

The rally coincides with the last weekend of the Sapphire City Festival, held annually at Inverell. As part of the festival, a procession through the main streets is featured. If suitable transport, i.e. large low trailers can be arranged, rally members are invited to take part in the procession if they wish to. It is envisaged that we can transport models already in steam to and from the procession on these trailers without too much hassle. This will be entirely up to the individual owners of models and they are in no way obligated to take part.

We are expecting a good roll up of engines — the event is also open to partially built engines as well as model stationery engines, portable, etc. We also have a large pond suitable for model steam powered boats if anyone would like to bring them along. Last rally at Inverell, Frank and Ashley Blades of Brisbane attended with several of their fine paddle steamers which were of great interest

Looking forward to a great rally at Inverell, if anyone needs more information please do not hesitate to contact me on (02) 6722 4272

Gordon Blake

Taper Turning by Geared Crossfeed Drive — part 3

by Peter Dawes

Drawings for publication from author's originals by Rod Heslehurst

(In the previous two instalments I have suggested that you should really wait for the complete article before you try to use this method of taper turning. In this issue we come to the end of the main article. The series will conclude in the next issue with the appendices and details of the programs ... Ed.)

Storing the gearset and parts

The gears should be stored to protect the teeth from bruising and from dust and dirt. A quick and easy but effective solution is to obtain a shoe box. Cut a piece of dressed pine or particle board for a neat fit inside the box (see photo). Cut 6 to 8 pegs of 16mm dowel (for this example), to a length 5mm less than the height of the box. Lay out the gears in the box in some suitable arrangement, double, triple or quadruple banking them as required.

If you wish to also store the gear mandrels in the box rather than on the quadrants, then include three or four 9mm holes for them too. These holes should not be right through the board. 5/8" spacers can be stored on the pegs with the gears. To store bushes and their 3/8" spacers it is necessary to add a couple of 3/8" pegs in the spaces between larger gears. Also include a 5/8" hole for the bush removing tool shown in the drawings. This simple tool is very important and should not be overlooked.

The alternative to pegs for small parts is to make a compartment at the end and just put all the small bits and pieces loose into that, but that will take up more space and require a larger box. Making the pegs: Turn one end of the pegs to form a shoulder a full 9/16" dia. by 9/16" long (check for a tight fit in a hole drilled with the drill you are going to use). Chamfer the other end. Sand the pegs to a free fit in the bore of the gears with enough clearance for a coat of varnish. Sometimes the gears will have keys still in them when replaced on the pegs so it's a good idea to also make a saw cut 5/32" x 5/32" with the circular saw down the length of each peg to accommodate any key that might be present so that you don't have to remove it to store the gear.

The "shoe box" storage box with a set of 16DP gears, 5/8" bushes, 3/8" stub mandrels and washers, etc.

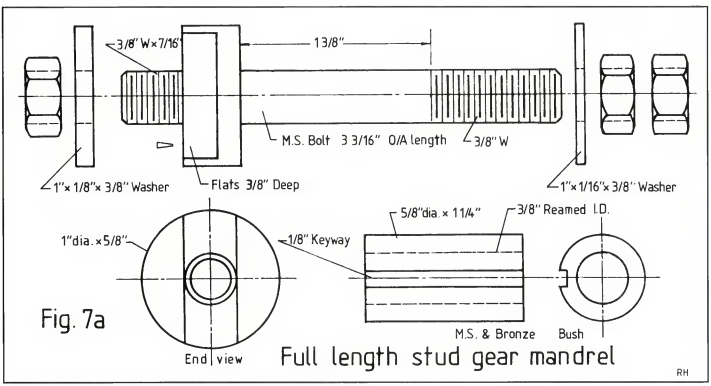


Fig. 7a

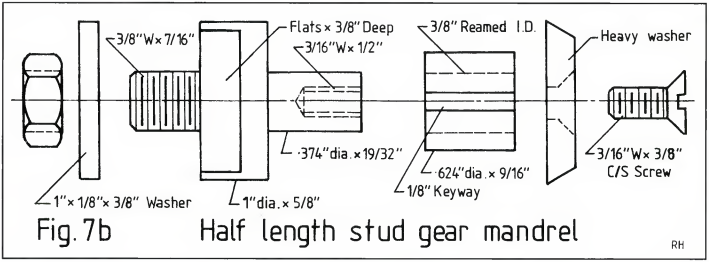


Fig. 7b Half length stud gear mandrel

RH

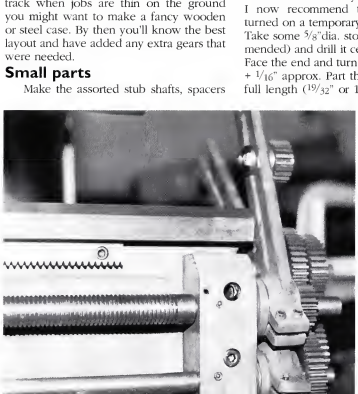
Drill the board right through where the holes have been marked and push the pegs in. They should be a firm fit, although if they end up loose they can be glued. Try to arrange for the tops of the pegs to be flush with the top of the sides of the box so that they help support the lid. The board and the pegs can be varnished if the quality of the surface is good enough, otherwise oil it well because bare wood absorbs moisture that rusts steel. Seal the outside of the box with a primer coat then enamel it to stiffen and stabilise the cardboard. One winter day down the track when jobs are thin on the ground you might want to make a fancy wooden or steel case. By then you'll know the best layout and have added any extra gears that were needed.

Small parts

Make the assorted stub shafts, spacers and washers, full length and half length keys, as specified in the materials list and in the parts drawings. But especially note the half length stub shaft and bush. The idea for these only came late in the design as another way to install an idler. I suggest bronze for half length shaft bushes since they will carry a small gear that will rotate twice as fast as the others. The half-length stub shaft is undoubtedly the best way to mount an idler or spacer gear.

Gear bushes

Since discovering the crucial importance of concentricity in gears and bushes I now recommend that the bushes be turned on a temporary mandrel as follows. Take some 5/8"dia. stock (bronze is recommended) and drill it centrally 3/8" less 1/64". Face the end and turn the OD down to 5/8" + 1/16" approx. Part the bush off to half or full length (19/32" or 1 1/4" as the case may be). Ream the hole 3/8". Now make a 5/8" long sleeve 5/8" OD x 3/8" ID with square ends (that is by parting off in the lathe). Make a 1/4" long sleeve similarly. These sleeves are for locking the gear bushes on a temporary arbor which we make next.



Front view of a gear train set up for a No. 2 taper which was shown from a different viewpoint in the last instalment.

Once the blanks for all the bushes are made, make an arbor to turn the ODs. It stays in the chuck until all bushes are machined. For the arbor take about 4" of 3/4" steel and mount it in the chuck or collet. Turn its end down to 0.374-0.375" for a length of 1 3/4" approx leaving a square shoulder on the inner end. Thread the outer 3/8" in the lathe, 3/8" x 16 tpi Whit. Don't remove the mandrel until every bush is machined to OD. Put a bush on the mandrel with a spacer tube and a nut to hold it. Turn the bush OD to 0.624"

When all bushes have been turned, cut the external keyways. There are two ways to do this. One is to hold them in a precision machine vice, aligned parallel to the ways, with a spacer bar in the bottom of the jaws to hold the bush horizontally at a fixed height. Or hold them on an arbor between centres in a dividing head. The first method is much easier and much quicker. Mill a keyway .068" deep in the bush with a one eighth inch end mill, from end to end. Repeat on all the bushes. An essential accessory for pressing bushes into and out of the gears is shown in Figure 8. It's a simple stepped round rod .620 at the thick end and .370" at the thin end. An arbor press is strongly recommended for all pressing and in any case is needed if a broach is used for internal keyways in washers and gears.

A gear cover

The final part required to finish off the taper turning attachment is a sheet metal cover to protect the gears and the worker. I haven't designed this at the time of writing. In the interim, the gears are removed between jobs, just leaving the quadrants in place with their stub shafts. Users who can cope with building the attachment won't need detailed designs for a cover, whose size will in any case, depend on the length they choose for the quadrant arms and on the configuration of the end of their lathe. Always remember to re-activate the cross-feed interlock after turning tapers. Loosen the 3/8" locknut then wind the rod out (counterclockwise) about 1/4" or until it reaches the stop. Re-tighten the locknut.

Finding the feed per turn of the feedshaft — D

We must determine the feed per rev of the feedshaft, to obtain the value of D as per Jeeves. (.0198922" on this lathe). There are two ways to do this. If the vari-

ous gears in the carriage are known accurately, calculation is the most accurate method. If not, do it by actual measurement. Measure the feed produced by say, 10 or 20 accurate turns of the feedshaft and read off the resulting feed on its dial. Divide that by the number of turns again. When the gears are known, as we know in this case from dismantling the carriage, we can calculate D.

Starting from the feedscrew worm (19T), assume one turn of the feedshaft. The wormshaft turns 1/19 (because it is a step-down ratio). This drives the intermediate feedshaft pinion of 40T via a 24T gear on the front end of the wormshaft. So it is 24/40, since it is also a step-down. For crossfeeding, the intermediate shaft drives the 48T wheel via the dog clutch, which in turn drives the 12T pinion on the crossfeed screw shaft, = 48/12, since it is a step-up. The feedscrew pitch is 4mm or 4/25.400 inches so multiply the total ratio so far by this pitch converted to inches, and we get: 1/19 x 24/40 x 48/12 x 4/25.4 or .0198922 inches.

Never round the steps individually. Do any rounding at the end of the calculation or you could end up with serious errors. Also, retain at least six digits of precision right through.

Finding the "lathe constant" — C

The pitch of the leadscrew is known. In the case of the AL960B it is 8 tpi (or 0.125" lead). If L=lead of leadscrew (1/pitch) and D=feed per rev of the feedshaft, for every turn of the leadscrew with a 1:1 ratio set up between the two, the in-feed=D, and the taper (on the diameter) = 2D inches. Therefore the change in diameter per inch of length = 2D/L inches.

We want to know what value of constant C that is inserted in the equation below will satisfy the equation for an infeed of half an inch, (so that the diameter change will be one inch). That is: 0.5 = C x D/L

Therefore C = 0.5 x L / D

C = .5 x .125 / .0198922

so C = 3.14194 (for this lathe)

What this means is that 8 turns of the leadscrew, which gives a longitudinal feed of 1", also drives the feedshaft to produce an in-feed of half an inch. Verifying by working backwards:-

8 x .0198922 x 3.14194 = .50

Suppose we want a No 3 Morse taper which has a taper of .05020" per inch. The required gear ratio between the leadscrew and the feedscrew is C x .05020 or .1594. The leadscrew must rotate 1 turn while the feedscrew makes .1594 turns. The computer program will actually compute the ratio for the taper as well as find the required combinations of gears, so that it is only necessary to enter the taper per inch when prompted. I've only done the calculation here to illustrate how it works.

Hints on using the system

We find a suitable set of gears from the computer program, and it tells us if an idler is needed. Although TPRGEARS can tell us if the set will assemble, I'll explain the theory in more detail here.

Setting up the gear train can be a lot harder than it looks. It's like doing a jigsaw puzzle in three dimensions. There are 36 possible ways of arranging 3 drivers and 3 drivens and it may well happen that it will only go one way, or that it won't assemble any way. So whenever you work out the train for a common taper, record the type of taper and how you set up the gears, for future use. Use the nomenclature described in Appendix 2 to name the quadrant slots and layers.

I have come up with seven rules for laying out gears:-

Rule 1. An even number of shafts causes the input and output to rotate in different directions. An odd number will rotate them in the same direction. Include the leadscrew and feedshafts as one each. This rule applies to any lathe and any gear train.

Rule 2. If the two shafts rotate in the same direction (specifically in the case of the AL960B) the taper that results is thin to its left and thick to the right — ie. the requirements for a socket or for the taper on the back of an R8 or 5C collet. Conversely if they rotate in opposite directions the taper is thick to the left and thin to the right — as you would normally cut a male taper in the chuck or between centres.

Rule 3. When two pairs of keyed gears are meshing on two shafts, both pairs obviously cannot be in mesh simultaneously. So one pair must have fewer teeth for them to be able to clear each other. The magic number is five, ie. the pair to have clearance must have at least five fewer teeth in total between them. With four fewer the two just graze each other. Five gives a small but adequate clearance.

Rule 4. When it comes to calculating clearances according to Rule 3, the diameters of shafts and bushes aren't negligible. So 5/8" shafts and bushes have a "gear equivalence" (GE) of 8, assuming 16 DP gears. That is because there are 8 teeth on a gear of 5/8" OD. If the gears have 1" diameter hubs, the GE of the hub is 14. The GE for a 5/8" shaft is incorporated into the formulae in the program TPRGEARS as GE+5 (8+5) because as we have just seen, 5 has to be added to the teeth total of the opposing pair to obtain a minimum clearance. (See the source code of the program. NB: The user whose gears are not 16 DP or shafts are not 5/8" diameter, should change this code accordingly.)

Rule 5. When designing assemblies with idlers, it's easier to work out four shaft assemblies than five, so do the design for four. Then either move the stub on Q2 to Q1, open out the quadrants and insert the idler on a stub mandrel on Q2, or add any idler to Q2 or Q3 immediately next to the shaft gear. This stub shaft is a half length one and the gear should be a very small one, eg 20T. Add the idler to whichever arm has the shorter radius to the main stub shaft.

Rule 6. This rule applies more particularly when working with steep tapers (those whose gear ratio is 1, or more than about 25 degrees included angle). This is because there is then a mechanical disadvantage in the gear train. If the program comes up with two combinations that are otherwise equal, use the one that has (1) the larger gears, and (2) doesn't have an extreme ratio in it. It's better to have two nearly equal ratios than one high one and one low one. Either way of course, combinations must be tested to see if they will "assemble", by using the TPRGEARS program.

Rule 7. Finally, in any step up gear train for a steep taper, to avoid damage to gears or pins, ensure that the gear train runs quite freely and that the lathe speed is reduced further to about 1/4 or 1/4 of normal turning speed. Reduce the cut and make sure there are no obstructions to the carriage movement that would strain the gear train.

An example — making a Morse No 3 arbor

We will set up male Morse taper No 3 as an example. This doesn't require an idler. Remember, four shafts result in the two feed shafts rotating in opposite directions which makes a taper thick to the left and thin to the right

Using the following steps:-

1. I didn't use the best error combination with the gear set because I had trouble finding a way to assemble it. Therefore I used the following combination:-

Drivers - 20, 25, 50

Drivens - 45, 55, 64

which yield a theoretical error of plus .065%.

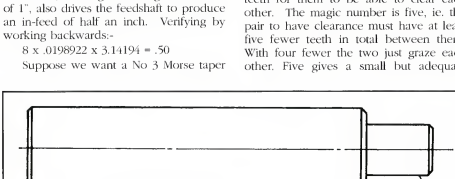


Fig. 8 Pressing tool

2. Choose a pair of gears to be the shaft gears, they must add up to no more than 65 teeth so use 20 and 45 for the leadscrew and the feedshaft respectively. They just clear each other by a mere one thirty-second of an inch!

3. Make up pairs of gears for the two bushes. In this case it would only work out with a 64+50 pair, and a 25+55 pair, (the 20 on the leadscrew and 45 on the feedshaft make up the third compound pair).

4. Assemble these pairs onto bushes on the bench, with long keys and with a keyed 1/8" spacer between them.

6. Put the 20T gear on the leadscrew and the 45T wheel on the feedshaft with half length keys.

7. Put a gear mandrel on Q2 with the 64/50 combination. Adjust its driven gear (64T) to mesh with leadscrew gear. Lock the stub mandrel position. See Appendix 2 for explanation of nomenclature Q1,2,3

8. Put the second bush assembly on a stub mandrel on Q3 and adjust the meshing with the 45T gear on the feedshaft. Lock it. The 55T wheel comes too close to the feedshaft for a collar to be put on it, so just put a plain 5/8" washer on the shaft as a spacer, and let the inner face of the 55T wheel hold it on.

9. Swing the upper quadrant Q1/2 down to bring the 50T wheel into correct mesh with the 25T wheel on Q3 and lock the upper quadrant arm.

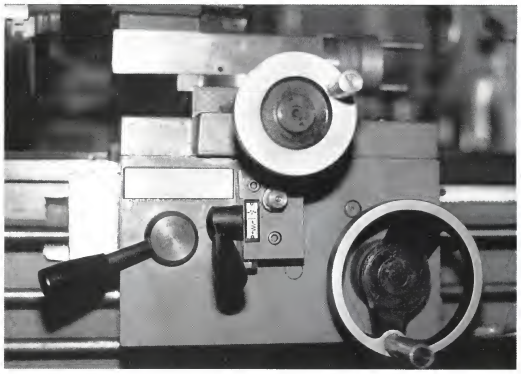
10. Put a 3/8" washer on each stub shaft and then a pair of 3/8" locknuts, allowing a small amount of end play for the gear bushes (say 1/32"). Oil all bushes.

11. We can cut in either direction, which must be set by the knob on the headstock. In this case feeding to the left is probably best. Whichever longitudinal feed direction is set, the crossfeed is still fixed by virtue of the even number of gears in the train to go "away" (cutting thinner) as the carriage moves to the right, or come "towards" as it moves to the left.

12. Set the screwcutting gearbox for a fine thread such as 112 or 224 tpi, which becomes the fixed horizontal feed for the cut.

13. Set the compound slide parallel to the cross-slide and use it as a manually adjusted crossfeed rather than use the main cross-slide, which can then be left for auto feeding. This is optional because it's always possible to set the infeed with the normal cross-slide before starting the automatic cut, although it is complicated as we shall see later.

14. Set an appropriate lathe spindle speed, definitely slower than normal turning speed on account of having to drive all the gear trains, say about half speed. Switch the screwcutting direction to whichever direction you want the carriage to move. Say we move to the left.



View of the carriage showing the "bolt" on the end of the intermediate feed shaft, just to the right of the warning plate. The bolt is screwed in to disable the crossfeed interlock. Also shown is the white plastic warning plate showing how to use the interlock disable mechanism and warning against trying to unscrew the bolt from the front.

15. Try this test cut on a piece of 1" steel because its OD is almost identical to the OD of the large end of the taper. For the initial roughing cuts, the tool tip can be V-pointed tool with a tip radius of about 1/32". When it comes to the final finishing cut however, use a freshly touched up gently rounded tool having a much larger radius, because the feed, remember, is fixed at either 1/112" or 1/224" per rev. (4 or 8 thou per rev.) and cannot be altered. Even so, that will not be a problem. Use cutting oil on the final cuts for a better finish.

16. Start the lathe.

17. To start cutting, engage both leadscrew and crossfeed simultaneously. This is easy because both levers move down to engage. Lift both levers simultaneously to stop the cut. However, there may be a delay in the engagement of the crossfeed if the gear teeth don't happen to line up at that precise position. For this reason it's best to set the tool depth and begin the auto feed some distance before the beginning of the actual cut to allow the motion to "take up" any leeway. This take-up distance can be half an inch or more, so start well back. Make the cuts. Before removing the job from the chuck, square its end, relieve the end about 1/16" dia. for about 1/8" to protect the tapered part, and drill a centre hole for future use. It might come in handy one day.

18. The result of this sample test which is really to confirm the values of constants C and D, was a taper that I couldn't fault when tried in two No 3 sockets on the lathe. I should mention that I had previously done a parallel turning test on the same bar before turning the taper, and while it was held in the chuck. I found only a very small error in headstock runout so I didn't bother to adjust the taper figure and recalculate the combinations. I would expect that all that would happen is that it would have produced the same set of combinations but with slightly different error figures, one way or the other. Further tests will be needed to evaluate the method with other tapers, particularly steep tapers, and to decide what the maximum acceptable error limits are going to be. At present it appears that .01% should be aimed for, is quite achievable, but likely to be better in theory than any machine can deliver in practice.

A general precaution — There is a requirement when turning a taper by any method, that the tool be set accurately to centre height, or there will be a slight error in the taper.

To be Concluded ...

The conclusion to this series in the next issue comprises four appendices which tie the whole project together. Included will be —

- **data tables for tapers, some terminology and**
- **details of two computer programs which calculate all possible solutions for any set of gears and detail how to asemble a set of gears on the quadrants.**

Sparks 'n' Arcs

with Stan Allison

Series traction motors

First let us look at rewinding a DC relay or solenoid to allow operation on a different voltage. A formula to calculate the new wire gauge is:-

$$d_1 = d_2 \times \sqrt{R}$$

where d1 and d2 are the new and original wire diameters respectively (ins or mm) and R is the ratio of original voltage divided by new voltage.

(There is a square root button $\sqrt{X}$ on most hand held calculators) It is necessary only to wind on the same weight (no less) of wire as the original coil — the exact number of turns is not critical. As far as is possible, layer wind the new wire and to a slightly greater depth if there is room. You will find Winding Wire Data in the back pages of a Dick Smith Electronics Catalogue.

The same approach can be used to rewind the Shunt (voltage) field coil of a DC motor to a new voltage, but we encounter difficulty when trying to rewind a 12V Shunt field coil for series (current) use — there is no easy formula for this. However, several pointers can be used to guide us when winding a series field coil, namely:

(1) the new wire cross section should be the same — plus say 15% to assist cooling - as that of the armature wire multiplied by the number of parallel paths through the armature. Two paths for two-pole motors, four paths for four-pole etc. lap winding; two paths for wave winding of any number of poles. (Most small motors are two-pole). The new series coil wire diameter can be calculated from:

$$d_1 = d_2 \times \sqrt{N \times 115/100}$$

Where d_1 and d_2 are the new series coil wire diameter and the existing armature wire diameter respectively and N is the number of armature parallel paths. 115/100 gives the extra 15% wire cross-section.

(2) it should be apparent there is a working relationship between the armature turns presented to each pole and the number of turns on each pole field coil. For a two-pole motor, there are two parallel paths through the armature (i.e. half the armature current per path) so if there are 28 armature coils of five turns each, there would be $35\left(\frac{28 \times 5}{2 \times 2}\right)$ turns on each series field coil, a ratio of one to one. Actually the ratio could be as high as 1.8 to one in favour of the field coil(s) to allow for 'field weakening'. (See below)

(3) Let us now make some assumptions. Our motor originally, as a generator could output say 30 amps with a regulated field of 8 volts. Assume also the rewound series field coils to have a one volt drop at a motor load of 30 amps; converting from say 480 total Shunt field turns to series field turns would give $\frac{480 \times 1}{8}$

or 60 turns total or 30 turns on each of two coils. Of course, the final series motor would hardly ever show a steady one volt across the field coils — the volts (IR) drop would depend on the armature current. But our assumptions are reasonable as a full scale traction motor could show say five percent of the line voltage across the field coils whilst our small, less efficient motor could show about 10% or

(4) If you think items (2) and (3) are too much jazz, a rule of thumb could be applied by winding each field coil with the same weight of wire as the original shunt field coils (or slightly more wire depth if there is room) but using a wire gauge as calculated under item (1) above or

(5) you could acquire a motor similar in make to one that someone else has successfully modified, and modify your motor in the same way. Arthur Richards has devised his own modification (AME issue 74, page 23) and his tests show the results to be satisfactory (and he used the original coil wire).

Several points should now be noted:

(a) The original 12V armature needs no alteration.

(b) The finished series motor can be operated at higher than 12 volts provided the rated current is not exceeded under a steady running load. 24 volts would give twice the output wattage at twice the original RPM (746 watts = one horse power)

(c) The different approaches to determine the new series coil turns, (2) to (5) above, could give a different number of turns.

If you get two close numbers, choose the higher figure - the finished motor will be quite forgiving. Refer to (2) above if you wish to use 'field weakening' to control your motor at top end RPM — a common full scale practice — bring out a tapping 25% turns from one end of one coil and a tapping mid point (or at 50% turns) on the other field coil. More on using these tappings in a later instalment.

So finally, provided you adopt a reasonable basis for calculating your conversion to series use, the motor should be satisfactory. Some experimenting could be necessary e.g. adjusting the reduction gear/sprocket ratios to the axle(s) or by connecting a partial shunt across the series field coil(s). More on this later.

DC motors for model traction (other than series types)

Both Permag and Shunt motors have an advantage in being usable for model traction work without being altered. Both types try to maintain a constant RPM but this can be varied by *voltage* control of the armature.

Solid State or Pulse circuitry can give this constant voltage control for continuous running at any desired speed (RPM). If the motor RPM is too low with a 12 volt battery, a 24 volt battery can be used and the pulse control adjusted to give the desired motor RPM. This control is achieved without loss by heat, as happens with resistive control.

Pulse control switches or 'chops' the DC supply on and off at anything up to 40,000 times (cycles) per second (CPS) or Hertz (Hz), the term mostly used these days. Regulation is achieved by the adjustable length of time the current is allowed to flow during the 'on' period of each cycle. A suitable pulse circuit is given in the *Electronics Australia* magazine (October 1994, Page 68).

Shunt motors

A comment on the above paragraphs is that a shunt motor needs the field supply to be fed apart from the regulated armature supply, i.e. the field must not be regulated in the same way as the armature. Further, auto generator fields are voltage regulated to control the armature output voltage so the field may operate normally at about six to eight volts. If the field is connected to 12 volts when used as a motor, the motor could run at an RPM too low to be of much use. In any case a field thus connected to 12 volts could get excessively hot.

The answer to this is to connect external fixed resistance in series with the field to bring the field voltage down to the six volts. Even so, the armature voltage still may need to be lifted to 24 volts to achieve an adequate power, in which case more field resistance would be needed to keep the field at six volts. Fixed resistors are heat wasteful, but it is possible to use a 12 volt auto generator 'as it comes', but you would need to experiment to get reasonable starting torque at one end of the performance scale and reasonable speed (RPM) at the top end.

If your motor happens already to be a dedicated 12 volt shunt motor, designed to

operate at a fixed RPM, you would need only to build out the field fixed resistance in the event of needing to increase the armature voltage to 24 volts.

Permag motors

Apart from adjusting the final drive reduction ratios to the axle(s) and adjusting the applied voltage by, say, pulse control, there is not a lot you can do to alter the performance of a permag motor, but these two adjustments could be enough.

It happens that the control given by a pulse device is rather rigid at any setting - the voltage is not altered much by the amount of current flow and this fits in with the permag motor characteristic of trying to work at a fixed speed relative to any applied voltage.

A permag motor needs relatively simple controls; the motor rotation is reversed by reversing the supply polarity and regenerative braking is achieved by switching a resistor across the armature after power has been removed.

We will look at control circuits another time.

Sparks 'n' Arcs is another column for you, the reader.
If you have any topics related to electric traction which you would like to share, questions you need answered, send them in to AME

Automatic Drain Cocks

Peter Wardle replies ...

Enclosed as promised, details and notes referring to the Automatic Drain Cocks published in AME issue 85, p 48.

Firstly, the drawing of the drain cock is NOT as I sent it. The dimensions have, on your drawing, been indicated as fractions of an inch, e.g. bore size $^9/_{64}$". I suggest the main 'bore' size plus the depth of that 'bore' should be returned to the decimal size originally given and these should have a machining tolerance of ± 0.001". (The conversions are correct)

Secondly, the way the drain cock works apparently has caused some comment! It's easy. The whole thing is operated either by water (to open) or steam (to close). Water has the lower density, thus will allow the ball to drop off its seat and open the valve. Once open the valve will discharge any water.

Once the water has been discharged, higher density steam takes over and momentarily rushes for the opening (this gives the ball its direction). The denser steam then presses the ball against its seat and seals the drain cock, that is until more condensate accumulates and the 'cycle begins again.

Thirdly, these automatic drain cocks also act as snifting valves!

(With reference to Peter's first point — I should mention that the drawing was not sent directly to AME, but to John Cummings, who had it redrawn for his own use and with a view for publication in Garratt Gossip. John has so far built four of these drain cocks to the drawing as published and he says they all work like a charm. It would appear that whichever dimension type you use, it is essential to work to accurate conversions. Peter has also stated that the $^1/_{16}$" outlet should be soft soldered on because the passage of water through the hole causes wear. Soft solder makes it easier to replace ... Ed.)

On the subject of Garratts

Peter says ...

I make note of a letter on pages 57-58 of the same issue "Garratts"

I have a copy of H W Garratt's original **Patent Application No. 17165 AD 1907** (British Patents Office)

Date of Application: 26th July 1907

Accepted: 11th June 1908

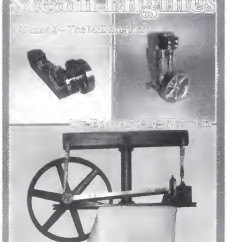
This is the original patent application and the drawing with the application shows the cylinders at the **outer** extremes of the chassis. On this basis, K1 with cylinders **inboard** on the chassis was never covered by the subsequent Patent, and certainly a one off (design). Further patents are "improved components for the Garratt"

Peter Wardle

(Ex Beyer Peacock Apprentice, UK)

Product Reviews

Home Made Steam Engines Volume 2 - The Mill Engines



By Edward G Warren

Card cover (colour), 46 pages (280mm x 215mm), Monochrome throughout. Published by Camelback Press

This book is the successor to ***Volume 1 - The Wobblers*** by the same author (and available direct from the publisher for the same price). Some readers may recognise Camelback Press as the publishers of *Modeltec* magazine in the US.

This book contains full instructions complete with excellent drawings to enable the reader to construct a variety of model mill engines. There is a beam engine, three vertical engines and two horizontal types. These single cylinder engines would all make excellent projects for the newcomer as well as being of interest to the more experienced.

There are several pages devoted to each project, packed with very clear, easy to follow drawings and text. There are also some photos, though the number does vary considerably from engine to engine. Some people may like to see more, but in this reviewer's opinion, the drawings and text are so descriptive that additional pictures are not needed.

The book contains several other projects, equally well presented. There is a boring bar holder, a home made boring bar, metal bender and a tap holder. In addition there are informative articles on holding four-sided objects in a 3-jaw chuck, cylinder boring and parting, three exercises which have, at one time or another, caused all of us some frustration.

Anyone starting out in the wonderful world of steam models would find this book to be of invaluable help. Equally, someone who has been "at it" for years and wants a simple little job to do could well find it here. Good value for money.

Home Made Steam Engines
Volume 2 - The Mill Engines

Price: $24.95 plus $4.00 air mail post and handling (US funds)

Available from: Camelback Press, PO Box 1226, St Cloud, MN 56302 USA

David Proctor

Three Elegant Oscillators

By Roy A Ozouf

Card cover (colour), 50 pages (280mm x 215mm) Monochrome throughout. Published by Camelback Press

The author is well known to the readers of *Modeltec* magazine for his column *Ray's Shop*. This book is well illustrated with good clear photos and excellent

drawings. The engines described are aimed at those with a little more experience that those in the previous book (above).

On turning to the Table of Contents, the reader can see there are three engine projects as well as three other projects on workshop equipment. The engines are a double acting wall engine, a horizontal double acting engine and an elegant vertical engine, all oscillators.

The first engine, as has been stated, is a double acting wall engine based on one which appeared on an 1870 English calendar. The idea of wall mounted engines developed as a space saving measure and some interesting designs with rather ornate mountings evolved. Twelve pages of very clear, easy to read drawings, instructions and six photos make this a very straightforward article to follow.

The second engine is a horizontal double acting one which the author designed, when inspired by an undimensioned line drawing in an early English publication. This one takes up 14 pages of equally clear drawings, text and 15 photographs.

The third engine Coventry is a vertical engine with rather elegant supporting framework. The discovery of an engine of this type by Don Coventry, as reported in the *Model Engineer*, provided the inspiration for this design. 16 pages of drawings, text and 15 photographs mean that like the others, this engine is very well explained. There are also two photos which show a small selection of the author's huge collection of model engines.

As well as the articles on the three elegant oscillators, there are instructions on how to make a machine vice using only your lathe, a very useful and unusual V-block with its own clamp and a natty device for holding set screws (grub screws) to save your fingers when grinding down the length.

This book would be ideal for someone looking for a fairly simple project to build and would also have a place on the bookshelf of any practical person. Highly recommended.

Three Elegant Oscillators

Price: $24.95 plus $4.00 air mail post and handling (US funds)

Available from: Camelback Press, PO Box 1226, St Cloud, MN 56302 USA

David Proctor

Precision T-Rule and Marking Rule

You would think that trying to improve on the old faithful 12" steel rule would be a bit like trying to make an improved mousetrap. Well, with these two items, and others in the range, General Tools of the USA have certainly attempted just that.

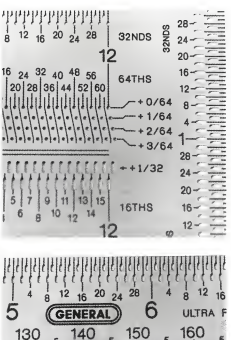
They were offered to me to try out 'as a useful item for us oldies whose eyesight isn't what it used to be'. They come in the usual blister pack complete with a matching stylus, what I know as a 'click' pencil.

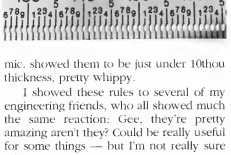
The different thing about these rules is that they have slots cut at every graduation so the stylus, either pencil or scriber, can be inserted and used to mark the exact dimension you are after. It seems to me that you need good eyesight to find the holes, but once located, it could compensate for shaky hands!

Certainly, these rules are impressive examples of the latest tool-making technology. The T-Rule even has holes at every $1/64$" graduation in a staggered pattern, plus $1/32$" steps across the end for setting depths presumably.

The Marking Rule, which has Imperial on one edge and Metric on the other, has slots at $1/32$" and 1mm steps respectively. The photographs show the blister packs and close-ups of the graduations which are impressively clear.

When I unpacked them, the thinness of the steel surprised me. Checking with a





mic. showed them to be just under 10thou thickness, pretty whippy.

I showed these rules to several of my engineering friends, who all showed much the same reaction: Gee, they're pretty amazing aren't they? Could be really useful for some things — but I'm not really sure what.

The leaflet that came with the rules called them INCRA rules and showed that they come in a range of 6", 150mm, 12", 300mm rules and T-Rules plus a Bend Rule which is like a piece of graduated angle-iron, and also a protractor. Steel scribers and pencils to match the rules are also on the list.

I believe that the protractor could well be the most useful item, but I haven't seen one as yet.

Looking through a woodworking catalogue recently I noticed that INCRA make specialised high-precision woodworking tools like dovetail jigs and so on. Whether General have taken them over or are just marketing the rules I haven't been able to ascertain. So there you have it. If you have a particular use, they could be good value.

Precision T-Rule

Marking Rule

Price: The two items supplied were priced at $39.50 and a 6"/150mm rule at $27.50.

Available from: Minitech Engineering & Model Supplies, Unit 6/16 Kenworth Place, Brendale, Qld, 4500. Phone (07) 3889 7689.

Dave Harper

PRODUCT REVIEWS

Prices stated in all product reviews are those quoted by the supplier and are current at the time of going to press.

Letter Box

Buying a boiler — beware!

Sir,

I am writing in the hope that this may save some members of the fraternity much anguish and even total disappointment. I refer to the purchase of a miniature boiler, new or used, especially one of steel construction.

Some time ago two members of my society purchased a steel Briggs type boiler from an ad. in AME. Both did this without seeking the advice of their club's Boiler Inspectors. One of the boilers is now ready to go and the owner was asked to produce the papers supplied with it. To say the least, the result was somewhat surprising.

The buyers were given a photocopied sheet of the Boiler Test Record from someone's record book. This listed a name only for the builder (no address or contact details), no details of the club (this was determined by the boiler number). There were no copies of the Boiler Plate Certification papers and the Batch/Heat numbers filled in on the Details section are illegible. The name of the welder is virtually unreadable, nor is there a copy of his qualifications supplied. The same applies to the Boiler Inspector's signature. Only for the fact that a couple of weeks before, a visiting member from the same club produced a certificate with the same scrawl, was it able to be identified.

I contacted the builder on behalf of the two members requesting copies of the Plate Certification and welder's qualifications. This was not well received with argument about costs, no trust and that out of 140 boilers, I was the only one to want these papers and he didn't keep them anyway. I hope that there are not 138 boilers out there without proper certification! The Boiler Codes give details regarding information and recording required in the design and testing of a boiler.

As the club and inspector concerned are not in the Association's insurance scheme, which covers boiler inspectors, I have had to write to the club requesting details of his coverage. All of these details should have been supplied with the boiler on delivery, and would have been if the Boiler Inspectors were consulted before purchase.

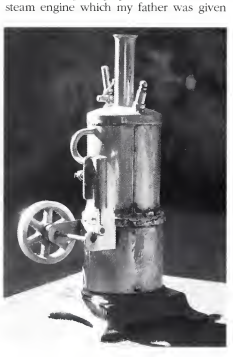
In this day of litigation at the "drop of a hat" all available means must be used by all concerned to protect themselves, their club and the hobby. Remember — always contact your boiler inspector before buying any boiler. It will save having problems later. Let the buyer beware, some inspectors are not as sympathetic as others in situations such as this.

Barry Glover
President
Australian Association of Live Steamers

Know this engine?

Sir,

This is a photograph of an old vertical steam engine which my father was given



for his 13th birthday in 1947. After some minor repairs a few years ago, this engine is still in good running condition at 52 years old, with its original metho burner. The original name transfer Renoun, remained on the side of the boiler for many years.

I would be interested to know if anyone has a similar engine or knows anything of the history of this make and model.

Clinton Taylor
Queensland

Paddlesteamers

Sir,

Congratulations on again producing a fine magazine. As always it has a wealth of information.

I have a couple of comments which may be of interest.

First, I agree with Terry Sexton about Australian made machinery. I have an old 4ft Macson flat bed lathe which is invaluable for the restoration of steam engines, its only drawback being that it does not have a gap bed.

The article of the *EMMYLOU* model is first rate as is the model itself. I would like to make a suggestion though to improve the authenticity of the model. From personal experience, I know that no helmsman who wants to stand a full shift at the wheel would hold the helm in the manner the helmsman in the model is. First you get absolutely no purchase of the wheel when standing directly behind it, and secondly, your arms would soon want to drop off if you tried. To steer a paddleboat with its large diameter wheel, you have to stand to one side. This enables you to pull the top of the wheel towards you with one hand and push down on the other. Some of the boats have quite heavy steering and this is the only way to cope. Most right handed helmsmen (myself included) usually stand to the left of the wheel. Some change from side to side as the river bends dictate, but I find this unnecessary unless it is a really tight bend, when in most cases you would call for the assistance of one of the spectators usually found in a wheelhouse these days.

Of the larger paddlesteamers I have had the pleasure to steer, the lightest on the helm is the *PYAP* at Swan Hill. Most of the larger boats are heavy on the steering, while the smaller ones vary from reasonably heavy to very light. I guess the easiest of all was the little 37ft *ROY*, which, providing no one was moving about, could be steered with a toe as one relaxed in a folding chair. The big problem with ROY was that she was very unstable due to her very narrow 8ft beam. If someone moved from one side to the other, you had to correct the steering as one paddle dug deeper into the water and the other came out of the water.

The other comment about the *EMMYLOU* article is that she is more the same than different to other paddlesteamers. By this I mean that about half the paddlesteamers had portable steam engines as their power plants, and about half of those portables were Marshalls. There must have been some good Marshall agents along the river as they were very popular. Of the existing boats, the *OSCAR W. MARION, MELBOURNE, JAMES MAIDEN* and *RANGER* all have Marshalls.

Denis Wasley
South Australia

(This is part of a recent letter from Denis who is the editor of Australian Steam Power *magazine and has a passion for paddlesteamers ... Ed)*

Automatic drain cocks

Sir,

Again a top issue, both in quality and quantity, especially the photographs.

One thing that has me guessing however, is the *Automatic Cylinder Drain*

Cocks on page 48 (issue 85). I reckon I'm pretty conversant with pressure release devices on locomotives, of which cylinder cocks are one method. In my experience, cylinders need to be closed at each end, when in normal operation, by some sort of valve. In the starting stage of a steam engine, when things are cold, some means of getting rid of the water has to be available. Once this has been achieved, things go down or up to relieve the excess pressure in the cylinder.

Anyway, it certainly created some discussion during smoko and crib at the track today. None of us could fathom out how the illustrated example worked. Perhaps the designer can provide a more thorough explanation.

Barry Glover

New South Wales

(Peter Wardle, the designer, has supplied some notes which explain the theory and operation of these simple drain cocks. His notes are at the top of page 56, along with some information relating to the design of the Tassie K1 and K2 locos. He also sent a photo of his latest Garratt which will appear in the next Garratt Gossip ... Ed.)

Radii on curves and points

Sir,

Whilst reading Kevin Bruderlin's fine article, *Back on Track* (AME issue 84), I recalled an event I witnessed on a state railway track during the mid thirties.

A steam hauled passenger express, on entering a city rail network, approached the left hand turnout of a set of points at too high a speed. The loco lurched alarmingly as it took the turnout and the right hand side driving wheels gave out the most awful high pitched scre-e-ech along with a marvellous display of sparks!

I learnt later (a) the turnout curve of a set of points is set at such a short radius and as there is no cant, or super-elevation, trains must reduce speed to medium or less to negotiate a turnout safely.

Further, (b) the design of an ordinary curve should ensure a train does not lurch as it enters the curve from the straight at whatever speed it is allowed to travel. This is achieved, especially on main lines, by inserting "transition curves" between the ends of the straight rails and the beginning and end of the main part of the curve.

A transition curve starting from the straight line is itself virtually straight and of infinite radius at this point (a "curve" of infinite radius is a straight line). The infinite radius decreases along the length of the transitions until they meet the main part of the curve where the radii match.

Also the cant of the straight lines is zero and increases along the transitions until they too match the cant of the main part of the curve of fixed radius.

Thus a train can negotiate a curve at its regulator speed without lurching or passenger discomfort. Interesting isn't it.

Stan Allison

Victoria

Conjugated steam valve drives

Sir,

Two interesting elements of this system are described below.

1. Expansion problems

The middle valve of three cylinder steam locomotives driven by conjugated valve drives, apparently could over travel or under travel, due to distortion through heat expansion of the outside mechanism.

One clever attempt to overcome this was a variation of the type of bearing used in the pin joints of the mechanism. An Arnold Weber, the Chief Mechanical Engineer of the Haine St Pierre Company in Belgium, patented spherical bearings for the pin joints. Any distortion through heat expansion in the mechanism would be absorbed by a compensating shift of the bearing housing around the spherical bearing. Consequently valve travel of the three valves would remain the same.

This mechanism was applied to three locomotives for Colombia in South America. Two 1000mm 3c/4-8-0 (c/nos 1521-1522 of 1926) for the FC del Norte (r/nos 7-8 — no. 8 is preserved at Flandres, Colombia) and one 914mm 3c/4-6-2 (c/no 1557/1927) for the FC del Pacifico (r/no 20, ex 47). Perhaps a reader can confirm that Norte no. 8 retains the above mechanism.

This arrangement is illustrated in a rear mounted version from Arnold Weber's 1931 book titled *La Locomotive a Surchaffe*. Modellers of three cylinder steam locomotives with conjugated valve drive may find the above a benefit to obtaining accurate valve travel. It could also possibly be incorporated into independent valve drive mechanism.

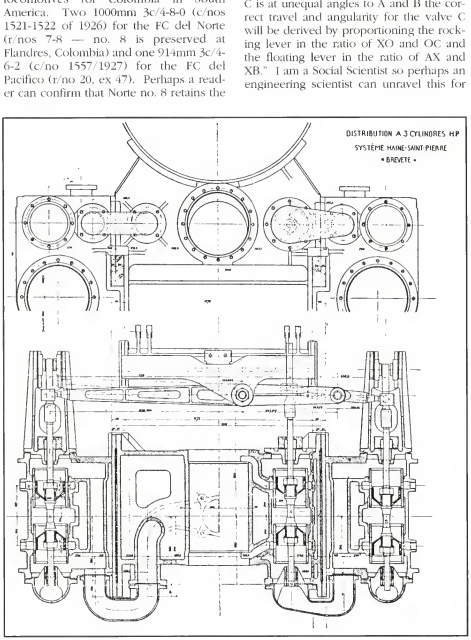
It should be noted that David Joy was the first to patent (UK no. 14107) a conjugated valve drive in 1884.

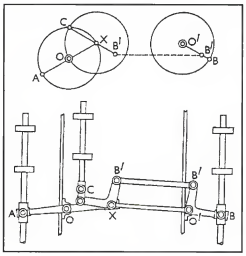
2. Crank settings

The above system of conjugated valve drive can only be applied to three cylinder locomotives with crank settings of approximately 120 degrees.

An article at p41 of *The Locomotive* for March 15, 1949, headed 'Conjugated Valve Gears' describes a conjugated valve drive for crank settings of 90-90-135 degrees or crank settings of similar unequal spacing.

The following quote describes the principles of this system as illustrated. "If C is at unequal angles to A and B the correct travel and angularity for the valve C will be derived by proportioning the rocking lever in the ratio of XO and OC and the floating lever in the ratio of AX and XB." I am a Social Scientist so perhaps an engineering scientist can unravel this for





us. It is possible that this mechanism has been used in marine applications.

James Tennant
Canberra

Dribblers (or Piddlers)

Sir,

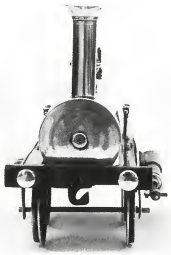
I do not often see a copy of your magazine but when I do it is always a pleasure to read it compared with the now much less interesting British version.

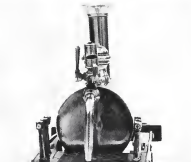
I have just been given a sight of Issue 84 and was intrigued by the photos of the *Birmingham Dribbler* submitted by Dave Jensen. The model is a commercial one, very similar to the one I have which belonged to my grandfather (I am now going on for 83), so it's pretty ancient!

My model is 6" long over buffer beams, $2^1/_2$" over frames and is 4" over cylinders. (I think Dave's quoted figure for overall width is wrong.) Wheel sizes are the same as quoted and the gauge is 2".

The method of firing has always puzzled me. We hung a spirit burner on the axles and ran it up and down the passage, leaving two trails of oily exhaust on the linoleum! The exhaust is through holes in the back buffer beam.

I enclose three photos taken by Nollie Stevens. The similarity is obvious. My version is engraved on the left side of the boiler:





NEWTON & Co
3 Fleet Street Temple Bar
London

I know of a larger version, I think the gauge is 3" (obviously by the same maker) in Johannesburg.

Geoff Wilkinson
South Africa

Sir,

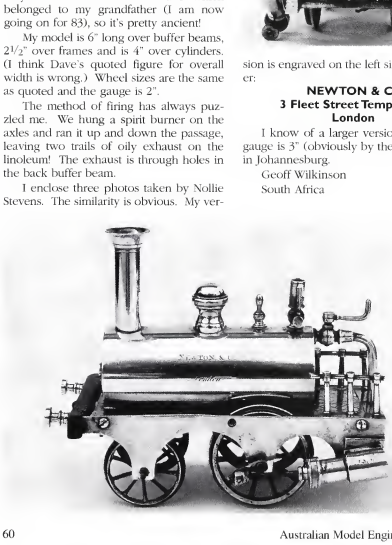
In response to your call for assistance via *Steam Chest* in identifying a model loco belonging to a Mr Dave Jensen of North Queensland that appeared in AME issue 84, I feel that I may be able to offer some assistance.

At the time of manufacture of Dave's model, there were many small companies, British, French, German and American involved in the manufacture of small scale commercially produced working steam locos. Of these, there were eight major manufacturers in London alone, and this is where a slight problem arises. Many of these companies were small with only a few workers building the models. Quite often they relied upon each other for fittings such as buffers and the like. Initially, Dave's model loco appeared to be a slight variation on a loco produced by the *Clyde Model Dockyard and Engine Depot* of Glasgow, which sold for approximately 15 shillings, but there were several differences – these being the added outside frames and in particular, the ornately turned steam dome. This pointed to a model from the Newton & Company, who were regarded as the best model loco manufacturers of this period.

From this, and to answer Dave's question, it appears that the model loco, a 2-2-0, was a commercial one made by the English firm of Newton & Company of London somewhere around 1875 and would have possibly sold for around twenty to twenty five shillings. With regards to today's prices, it may possibly be valued between $400 to $600. As to the fuel, yes it was a spirit job, with the commonest fuels being naptha, spirit of wine or methylated spirits.

As a further note, these small scale, commercially produced working steam locos were affectionately known as Piddlers as they usually left a trail of water behind them wherever they were operated, more often then not, on the dining room table.

Graeme Dale
Northern Territory



Letterbox Contributions

You are welcome to send letters by mail to:

PO Box 21, Higgins, ACT, 2615 or
fax to: (02) 6254 1641 or
e-mail to: **ame@dynamite.com.au**

As far as possible, AME is an open forum for all members of our hobby. Therefore, all expressions of fact or opinion, as long as they are not libellous, will be considered for publication.

Please **type or clearly print** your letters, as script is often difficult to interpret. Due to popularity of Letter Box and limited space, letters of **400 words or less** will have a better chance of being published.

News Desk

with David Proctor

Hello again and welcome to a very short News Desk this issue. Firstly a couple of requests from readers — does anyone know if change wheels can still be obtained, suitable for an old Qualos Junior lathe and secondly, are there any traction engine enthusiasts in the Northern Territory interested in making contact with a kindred spirit?

GST and AME subscriptions

No doubt you are all aware that as from **1 July 2000** GST will be added to the price of just about everything and that includes magazines, which were previously tax exempt. On the advice of the **Australian Taxation Office** we are required to start collecting GST **now** on any magazines which will be published after that date. Apparently it makes no difference to them if the magazines are paid for now or later, they still want their tax!

This means that, like many others, we are now becoming reluctant, unpaid tax collectors for the Federal Government. The price of all subscription renewals now has to include GST for the magazines which come from July onwards. If you look at the Renewal Form on this page, you will see it has been updated to include the GST for the July and September issues. Next issue will have November 2000's GST added, and so on. AME will have to bear the cost of any July ones already paid for as it is not practical to collect GST on these at this late stage. This is just one of the many headaches which will be caused by our "new simple" tax system — you should see the extra paper work!

Classifieds

Locomotive for sale

- Professionally built 7¼" gauge diesel look alike based on NSW 41 class. Main drive motor 9HP Honda petrol, driving hydraulic pump supplying power to 4 motors mounted above each axle. As bogies are Bo-Bo type, they are sprung to allow each axle freedom of movement. Combination of each axle being independently driven ensures smooth operation even on roughest tracks. Geared to operate at 10Km/hr and capable of hauling 40 adults on level ground. Now 2 years old with about 40 hours running. Also driving truck, bogie type, hydraulic hand brake, can be detached from loco in minutes. $12000 or reasonable offer. Further details contact Stan Kirk (07) 5524 5444 or (07) 5524 9027 or fax (07) 5524 3001 or write to 13 Aberdeen Court, Banora point NSW 2486

Australian made Advance lathe for sale

- 7 inch swing, 12 inch between centres. v.g.cond. but needs guards and chuck. $450. Peter (03) 5664 1328 or mobile 0407 336602

Victorian Railways rolling stock

- now under construction for 5" gauge. Currently available are ZL goods brake vans, GY, IY and T wagons, ICIANZ specialised sulphuric acid bogie tankers. All wagons are painted, coded, individually numbered and 'Ready-to-Run'. Future projects include P, K, I and Q wagons, fuel oil tankers, AE, BE, diner, sleeping and observation passenger cars. For details and information contact Dennis or Erik at: Live Steam Locomotives & Rolling Stock, PO Box 492, Daylesford 3460 Vic or phone/fax (03) 5348 4135 or email: steamers@netconnect.com.au

7¼" loco 2-6-2 for sale

- Bronze cyls, 50 x 75, Piston valves, copper boiler, with braked riding truck and water tank 3 years old. $6200
- Same as above, 70% finished, rolling chassis, cyls bolted on. Baker valve gear, finished boiler, needs more brazing. $3300 Contact Ed (03) 5795 3705

(Classifieds continued next page ...)

Classifieds

Miniature village for sale

A magnificent tourist attraction in the premier seaside town of Victor Harbor, South Australia for private sale by expression of interest. The village is set in an award winning garden on level ground of 18 acres, highly suitable for a miniature railway. Thriving business includes modern tea rooms, gift shop, nursery and separate 3 bedroom residence. Further enquiries to PO Box 520, Victor Harbor 5211.

D.I.Y. Electroplating and Anodising

- New Computer Software - Provides an introduction to enable any Model Engineer to successfully carry out Nickel and Copper Electroplating or Aluminium Anodising. Includes easy to use Area, Current Density and Time Calculator with proven methods and formulae for reliable results. Requires Y2K compatible PC with Microsoft Windows 95-98. Introductory price $29.95 including post. Available only from D.I.Y. Soft, 9 Woodbry Crescent, Tamworth NSW 2340 or Ph (02) 6761 8416

5" gauge SRRL No 24 locomotive for sale

- Copper boiler, current certificate. Unit in A1 condition. Approx 10ft long, 20" wide, 30" to top of cab. Photos available. Rolling stock if needed. $25000 ono. For more info call George Selby on (02) 9415 1535

5" gauge NSW 80 class loco for sale

- Diesel profile, "petrol". Driver's truck, 2 passenger cars. $8000 (02) 4945 3710

Miniature railway for sale

- 7¼" gauge, over 1000 metres of track, riding trucks, extra steel sleepers, 12ft turntable and 2 bridges. $16,000. Phone Rod (08) 8536 2489

5"g GWR 5700 class 0-6-0 tank engine for sale

- Fine detail, runs extremely well. Current AMBSC ticket. $6500 ono. Ph. Colin (03) 9578 8791

5" gauge locos for sale

- *Metre Maid* 0-6-0 narrow gauge, boiler cert. to Sept 2000. Loco 18 months old $4000 ono
- *Sweet Pea* 0-8-0 narrow gauge, boiler cert to Jan 2002, Loco 9 months old $4200 ono. Ph. Harold (03) 9795 9030

7¼" Baldwin 0-4-2T logging locomotive for sale

- With driving carriage. Loco 1.12m long, carriage 1.45m long with large water tank. Copper boiler, certificate to April 2000. Good steamer, a lot of fun and easy to drive. Asking $6800. Ph (03) 5480 7206

Steam traction engine for sale

- 1/3 full size model of Tasker A2 engine (shown AME issue 83, page 24), copper boiler fully certified. Price neg. For further details contact Bill Fowler (02) 4981 8096

Wanted - information, articles, photos, advice, etc

- To assist with current project involving restoration of the following Australian-made machine tools:
  "Lock" Model 10 (10 inch) shaper made by the Lock Tool Company P/L, Fitzroy, Vic and
  "A E Herbert" Model CC tool and cutter grinder (bench mount) - probably made under licence in Australia during or soon after WW II. Please contact John Bates Ph (02) 9858 5094 or email: urbansystems@bigpond.com

Hercus 260 lathe accessories

- Make your own vertical milling slide attachment, plain saddle stop or milling spindle attachment with castings and drawings developed to optimise your lathe's potential. Phone A Hudson on (02) 4942 8716 for information brochure and price list.

3½" *Maisie* Atlantic 4-4-2 (LBSC) for sale

- 1¼" bore 5⅜" stroke with 6-wheel brass tender. Copper boiler by Alex Russell (26 fire tubes, 4Galway tubes and combustion chamber), 100psi. Cert to July 2001. Ride-on flat car with handbrake. Good scale model, easy to steam and ride, no defects or wear. $5000 Ph. (02) 9529 9937

5" gauge loco for sale

- Steeple cab electric 0-6-0. Two 65 A/h batteries, excellent condition. $1500 ono. Ph (03) 9841 7678

7¼"gauge narrow gauge loco for sale

- 2-6-2 14" steel boiler, boiler certificate just renewed. 3½" x 5" cylinders. Loco 4 years old. POA. Phone Jack (02) 9823 9652

Steam launch for sale

- 18 ft. brand new on brand new trailer. $25,000 (08) 8536 2489

Traction engine for sale

- With associated equipment, twin cyl. approx 1½" x 3" stroke, to resemble compound, length 4'10", height (chim) 3'4½". Wheels 20½" (rear), 13½" (front). Copper boiler 2' x 8" dia., coal fired, AMBSC cert. Also 2-wheel pneumatic tyred driver's trolley w/vintage cast iron seat, one 4-foot wagon (4 tyred wheels) carrying mini working fairground organ, removable to carry passengers. Also 2nd 4-foot wagon, solid tyres. $20,000 the lot. Ken (08) 9378 2121. Mech. details Bob (08) 9451 7631

Subscribers Free Market

FOR SALE

50th scale glass hull, Bay class *Minehunter*, some above-deck detail completed, with orig. drawings and 2 motors. $200 neg. Ph. (02) 4967 1350

5" C38 new copper boiler from E Winter's drawings, hydro test certificate. $3000. Ph. Bruce (02) 9772 1318

240 Volt 10 inch stroke **Omerid shaper**. Good order. $400 (03) 9758 3514

Model Engineer 31 volumes, *Engineering in Miniature* 9 volumes, *Live Steam* 2 volumes, some incomplete. Norm Alexander (02) 9750 0397

Baldwin loco 5" 0-4-2, bogie and 4-wheel driving trucks. Loco test run only (medical reason) $5000 (03) 9314 6352

Milling machine TOM Senior Major H/V $4200. Myford Super 7B lathe, industrial stand, taper collet, accessories $6200. Ph. (02) 4861 7837 Ron

Incomplete 0-4-0 ***Alice* type 5" Hunslet**, complete chassis, running on air. 6" copper boiler, AMBSC code plus extras. $3200. kevin (03) 5752 2350

Lucky Seven, Don Young design, full set of plans, castings, wheels, cylinders $650. Ph Col Campbell (03) 9796 8481

WANTED

Manual or copy for early model 3½" centre height *Advance* lathe. Phone Bernie (08) 9367 3860

Steam loco 5" or 7¼" prefer good order, RTR. Also 0 gauge VR. Ph. Philip (03) 9331 2375 or mobile 0417 360525

Model Craftsman magazine for July/Aug and October 1936. Ed Gladkowski, 248 Deans Rhode Hall Road, Jamesburg, NJ 08831-3003 USA

News Desk — Important information

Classified rates

- $3.50 per line as published (including heading).Don't send payment with ad, we'll invoice you after publication. No limit to the number of words.

Subscribers Free Market conditions

- Non-commercial only, at the publisher's discretion.
- Maximum of twenty words, including your contact name, phone number or address.
- Posted, on special form provided. No faxes please.
- 5" gauge or larger locomotives (for sale) are not eligible.
- Only one entry per issue.

Advertising Index

AME Retail - Books, Videos, Plans, etc. 67
AMRM Magazine 7
Argyle Locomotive - Baldwin 0-4-2 1:20 scale kit 8
Australian Steam Power Magazine 65
Camden Books: Special list 66
E.&J. Winter - Locomotive C36, 5"g kit 7
E.&J. Winter - Model Engineering Supplies 66
E.&J. Winter - Stationary Engine, No.5 Kit 65
Emco - Model Engineering Supplies 65
Emco - Twin Vertical Stationary Engine 66
HAFCO Workshop Equipment 9
Herless Machine Tools 2
Hobby Mechanics - Budget Bogies 8
Hobby Mechanics - Locomotives 65
Hobby Mechanics - Quorn T&C Grinder 64
Hobby Mechanics - Versatile Dividing Head 6
Hornsby Model Engineers Annual Steam Festival 8
Live Steam Models - Pressure Gauges & valves 8
LPR Tools, Videos, Books 4
Minitech - Tools 63
Myford Machine Tools Australia 6
Plough Books - General list 68
Plough Books - Special Feature 4
Rolling Stock and Detail Components 64
Rolling Stock Components & 5"g Track 63
Series 567 Steam CDs 10
Strath Steam - Stationary Engines and Boilers (full-size) 65
Stuart Models - Stationary Engines 7
The Diamond Tool Holder 6
TOMM Magazine 7
Wayne Roberts - Model Engineering Supplies 64

AME Retail

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50 Years of the Sydney Live Steam Loco Society	$11.50
Among Their Favourites	$37.95
Australian Diesel Scene 2	$27.00
Australian Diesel Scene 3	$32.00
Australian Steam Locomotives 1896-1958	$65.00
Away with Steam	$25.00
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Byways of Steam - 7	$27.00
Byways of Steam - 8	$27.00
Byways of Steam - 9	$27.00
Byways of Steam - 10	$30.00
Byways of Steam - 11	$32.00
Byways of Steam - 12	$32.00
Byways of Steam - 13	$37.00
Byways of Steam - 14	$34.00
Compendium of NSW Steam Locomotives	$48.95
Essays in Steam	$37.00
Four Decades of Railway Photography	$39.95
Full Steam Across the Mountains	$39.95
Green Diesels - 40 and 41 classes (NSW)	$49.95
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Locomotives of Australia	$54.95
Man of Steam - E.E. Lucy	$35.95
Motive Power - Dev. of Modern Aust. Locos	$44.95
Rail Scene NSW Vol.12 (soft cover)	$39.95
Rails to Wealth - The Silverton Tramway	$47.95
Remember When	$59.95
Shimmer of Steel (book with 105min PAL video)	$104.95
Shimmer of Steel (book only)	$64.95
Standards in Steam - The 50 class (soft cover)	$39.95
Steam in the Sixties	$34.95
The 34 & 35 classes	$49.95
The 57s and 58s (3-cylinder power on NSWGR)	$54.94
The 60 class	$44.95
The Blowfly Manual	$49.95
Tracks in Time	$39.95

AME Safety Appliances

Vacuum Ejector $21.50

Videos

South African Winter Steam $44.95
A look at reopened narrow gauge ex South African line in the east of the country and various Garratts hauling heavy coal trains. 55 minutes.

Steam Fever $44.95
South African video looking at aspects of mainline work in the final days of steam. Incl. "Red Devil" and Class 25 condensing locomotive.

Superlatives In Steam $44.95
Shows some of the largest steam locomotives in preserved working order on US railways. Incl. Nickel Plate Berkshire 2-8-4 no.765, Norfolk and Western 'J' Class 4-8-4 no.611 and Norfolk and Western 'A' class Mallet no.1218, 1218 footplate and restoration Scenes included.

Challenger Through The Rocky Mountains ... $44.95
This video records the 1991 trip across the US by Union Pacific 4-6-6-4 Challenger no.3985 and 4-8-4 Northern No. 844 from Wyoming to Sacramento, California. Cold conditions add to the spectacle of preserved super power at work.

24 hrs. of Live Steam $24.95
An A M E production showing 5"gauge live steam locomotives in action hauling heavily loaded trains of between one and two tonnes on the Illawarra Live Steamers track at Wollongong. Action includes NSWGR 35, 36, 38, 50 and 59 class locos along with shots of Simplexes, Blowflys and Sweet Peas.

Magic of Steam $44.95
A 40 min. EK video look at East German preserved steam at work in revenue service during 1989.

Destiny of Steam $44.94
1970s footage of South Maitland Railways. A rare and historic insight into one of Australia's larger private railways. Duration: 60min.

Milestones in Railway Preservation (Australia) $54.50
Written and directed by Graeme Belbin. Qld's 130 year old A10 No.6, to a Victorian R class leading 3 diesels. 3830 and rare archival scenes — tripple headers out of Lithgow in the 1950s and black 3801's supposed last run. Duration: 90min.

Steam and Diesel Railway Review .... NEW ... $44.95
Covers rail action of WA, SA, Tas, Vic, Qld & NSW. Digitally mastered and professionally narrated.

Steam Rails and Sugar Cane ..... NEW ... $44.95
Features historic footage (1957, 1966 &1968) of Qld's narrow gauge in the sugar growing area. Also QR steam and rail motors.

NEW

From Eveleigh Press...

Advance orders taken for August release date:

COACHING STOCK OF THE NSW RAILWAYS

A 260 page volume by David Cooke, Don Estelle, Keith Seckold. and John Beckhouse. Illustrations by Dennis Toohey

Covering in detail, the design, construction and operation of carriage stock on the railways of NSW.

The groups covered in **Volume 1** include:
The four- and six-wheel passenger stock, including brake vans, hearses, horse boxes and carriage trucks.
Early bogie cars including Cleminson, Redfern, Ashbury and others),
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Miscellaneous Lucy-era cars including SBX, SFX and ACX.
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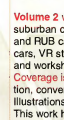
Volume 2 will cover: steel-underframed and steel-bodied stock including American suburban cars, Pullman and Pullman-type cars, the FS/BS and N cars, the HUB and RUB cars, Southern Aurora cars, Indian Pacific cars, South Maitland Railway cars, VR standard-gauge stock relevant details such as bogies colour schemes and workshops.
Coverage is extensive: There is comprehensive tabular information on construction, conversion and condemnation dates for each individual car.
Illustrations include photographs of every available type and drawings.
This work has been over a decade in the making, and includes the latest research from original sources. It is the definitive work on the NSW passenger carriage, and is unlikely to be reprinted. This is a once-only chance to get the most complete work on NSW carriages ever offered.

$95 (per volume) posted within Australia



422 class loco drawings
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